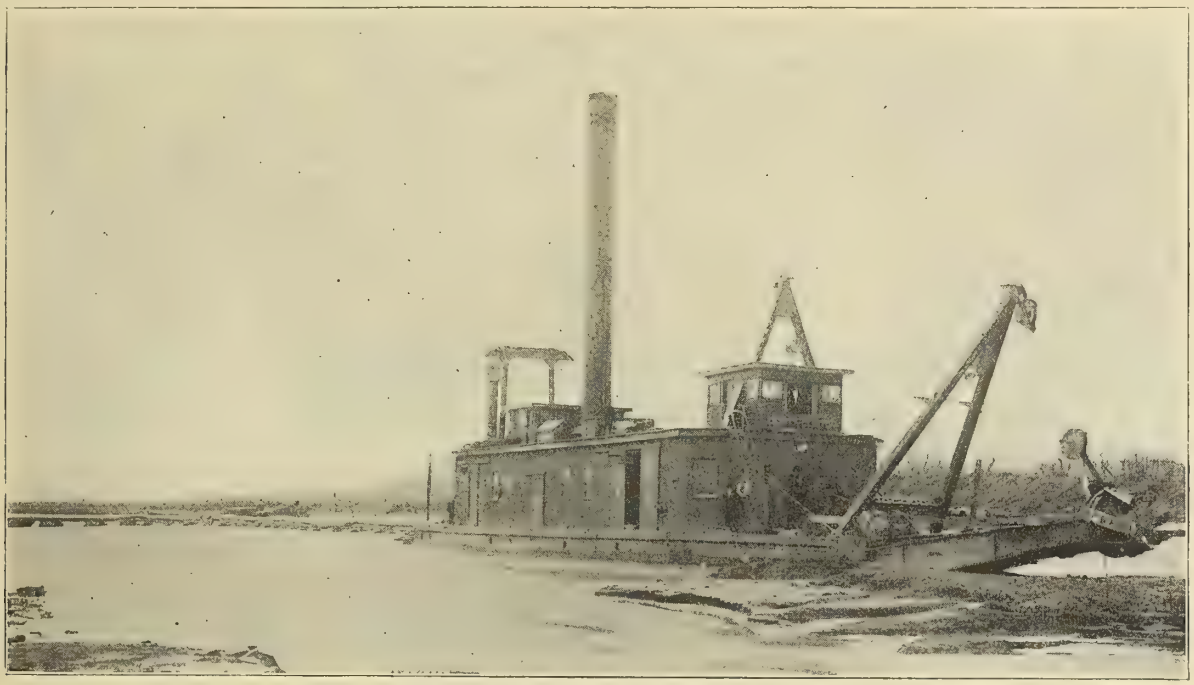
INDEXED.

International Marine Engineering

MAY, 1911.

A 20-INCH HYDRAULIC DREDGE.

The dredge illustrated herewith was specially designed to meet the particular conditions of the New York barge canal and is based on the design of the 30-inch hydraulic dredge, also built by the American Locomotive Company, New York, for the commissioners of Lincoln Park, Chicago. It was put in commission in September, and was in continuous service from that time until late in December, when winter necessitated the discontinuance of operations. In March, operations were again resumed. From Sept. 15 to Oct. 15, the total output, solid bank measurement, was 238,658 cubic yards.



20-INCH DREDGE BUILT BY ATLANTIC EQUIPMENT COMPANY.

During the first half of the month a great many obstacles, such as tree stumps and large boulders, were encountered, but the cutter and its machinery were proof against accident on this account. Most of the material excavated was a hard, blue clay, which had to be sliced off by the cutter blades before it could be drawn into the suction pipe. The cutter used is of the open type, with spiral chrome steel blades. Though complete data covering the whole period of operation are not at present available, a careful record kept for the fifteen days ending September 30 showed that the coal consumed was 1.85 pounds per indicated horsepower per hour, and the material was delivered at a point 1,200 feet from the dredge. One of the noteworthy and interesting features in the design of this dredge is the arrangement for supporting the suction frame and cutter drive. The upper part of the suction frame is formed of a large steel casting or trunnion head, which rotates in bearings let into the sides of the well. The countershaft of the cutter engine is located on the axis of these side bearings. The engine drives the cutter through a set of gears on the trunnion head. These gears are encased in a water-tight compartment, and oil pockets are provided, which keep the teeth of the gears constantly lubricated. A ball joint connects the suction pipe on the frame with the one in the hull. This ball is so located that it is totally immersed in water, thus preventing any possible chance of air leaking into the pipe.

The hull of the dredge is of wooden construction, with a heavy steel girder running fore and aft. It has a length of 137 feet. The width is 36 feet, and the depth is 10 feet 2 inches. A main pump of centrifugal type, built entirely of steel, is employed. The shell was made of extra thickness to compensate for wear, and liners were omitted to simplify its construction, their continual removal being more expensive than a new shell replaced at long intervals. The main pumping engine is of the marine vertical, triple-expansion type, and indicates 700 horsepower at 225 revolutions. A heavy cast iron bed plate furnishes the foundation for the main engine and pump. On this bed plate are also located the thrust bearings, which consist of five adjustable cast steel horse shoes, babbitt-lined. They are so designed that any of them can be dismantled for inspection while the dredge is in operation, which materially facilitates the up-keep. The pump has a 20-inch discharge and a 20-inch suction. Its runner is 72 inches in diameter, which at 225 revolutions gives the required peripheral speed for discharging through 1,500 feet of pipe. The surface condenser, having 1,700 square feet, receives the exhaust from the main and auxiliary engines. Boilers of the water-tube type, carrying 175 pounds of pressure per square inch, are employed. They

have a total heating surface of 6,040 square feet, with a total grate surface of 135 square feet. Water is furnished to the boilers by feed pumps of the Admiralty type. These are connected with the hot well, which receives the condensed steam from the main engine, winch and cutter engines. A heater installed between the feed pumps and the boilers receives the exhaust from the smaller auxiliary engines. Large, easy bends, instead of the customary elbows, are employed in all piping throughout the dredge of a size from 3 inches up. This gives the minimum amount of resistance to the flow of steam.

The winch engine is an 8 by 10 inch double vertical engine. It has five drums for the operations of swinging the dredge and hoisting the ladder and spuds. A self-contained engine located in the hold of the boat drives the cutter. This engine has double cylinders 10 x 14 inches. Reducing valves are placed in the pipe line of both the cutter and winch engines, and the steam pressure reduced to accommodate these engines, which only require 100 pounds pressure per square inch.

New York State Barge Canal.

While it will be some time before the Barge Canal will be completed, it will be convenient to have the data given below at hand to guide those who may in the future be interested in building vessels to navigate its waters. A general outline is given of the various routes, which are in the main now fixed, although some slight changes may be made on further consideration.

There seems to be an error in the State publication as to the depth of water, as both 11 and 12 feet are given, but the latter figure is correct.

CUTTER OF THE 20-INCH HYDRAULIC DREDGE.

BARGE CANAL.

The width at bottom to be 75 feet minimum.

The depth to be 12 feet minimum; over sills, 11 feet.

Water cross section to be 1,128 square feet.

Locks: Length, 328 feet; width, 45 feet; depth, 12 feet.

All bridges, either fixed or lift, shall have a clear passageway of not less than 15½ feet at its highest ordinary water level.

ROUTES.

Eastern Division: From Troy up the Hudson River to Waterford, through People's Island by new canal and back to the Mohawk River to Little Falls to just east of Jacksonburg, to Herkimer to Rome, through Wood Creek to Oneida Lake.

Middle Division: Through Lake Oneida to Oneida River to Three River Point to Seneca River to Onondaga Lake outlet, continuing up the Seneca River to Jack's Reefs.

Western Division: Thence westerly up the Seneca River to the mouth of the Clyde River to the present canal, or a line selected by the State Engineer, to Fairport; thence following the old canal route to about four miles west of Pittsford, across country south of Rochester to the Genesee River near South Park, across the river to near Johnson and Seymour, then west of Rochester, joining the present canal one mile east of South Greece, following thereafter the present Erie Canal to near Medina to a junction with the Niagara River at Tonawanda, thence by the Niagara River to Black Rock harbor to Buffalo, and on to Lake Erie.

Opening and Closing: While in construction the canal is to be opened not earlier than May 15, and be closed no later than Nov. 15.

A Useful Broom Handle.

The life of the marine engineer is sometimes lightened by engineering experiences which are not included in the textbooks, and incidentally a good deal of human nature is displayed in the course of such incidents. One of these may be worth mentioning as a horrible example. An engineer's apprentice who was willing, but inexperienced, was sent to fit a sea-cock handle onto the sea-cock under the engine-room floor. As this was in a rather awkward position, the youngster was seized with a brilliant idea which was entirely original, and which nearly resulted in sinking the vessel. He thought that it would be a good plan to slack back the nuts of the sea-cock gland, take out the plug and fit the handle onto it in the vise. Immediately, however, that he got the nuts off the pressure of water outside the vessel (which was loaded) forced the plug out of the cock and the inrush of water knocked the youngster down. He was so horrified at the result of his ingenuity that he did not advise the engineer until some time afterwards. When, however, the trouble could no longer be concealed the problem of plugging up the hole became an urgent matter. The actual plug was under water in the bilge, and could not be found, and, after a few moments of agitated thought, the only thing that the engineer could think of was to sit tightly on the sea-cock until the plug was located. It was found shortly afterwards after the bilge pumps had been set to work, and replaced in the hole.

Trouble, however, reasserted itself. It was difficult to see how to get the gland on over the plug, as immediately the pressure of the hand was taken off the plug it was forced out again in projectile fashion. By dint of further brain processes the engineer got the idea of using a broom shank. The end of the shank was placed on the head of the plug and pressed hard home, while the gland was placed over the other end. The length of shaft allowed the manipulation of the gland down onto the plug, and it was then easy to fit it in position.

The main lesson of this illustration is to show that, no matter how smart an apprentice or unskilled laborer may be, it is inadvisable to give him the simplest job to do without exercising an adequate amount of supervision over him, as quite unexpectedly he may be seized with an inspiration of his own.

BROOM.

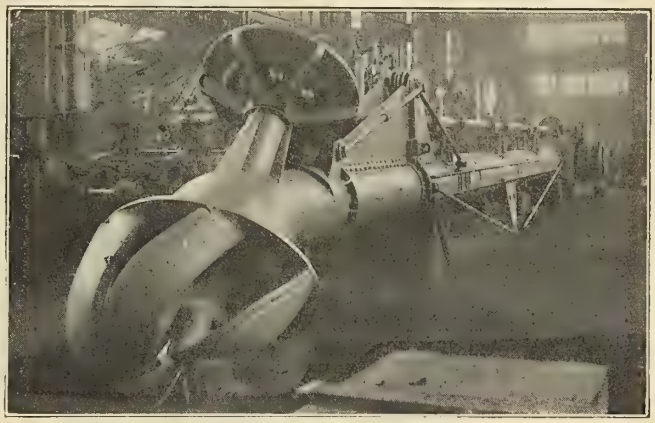
Newcastle.

The Captain John Ericsson Memorial Society of Swedish Engineers has taken permanent quarters in the Engineering Societies Building, 29 West 39th street, New York City. The membership of this society comprises leading Swedish engineers in all parts of the United States.

Clay-Cutting Suction Dredger for New Zealand.

The pontoon suction dredger illustrated herewith has been constructed for the Auckland Harbor Board by Fleming & Ferguson, Ltd., Paisley, for work in deepening the harbor and reclamation of land at that port. The vessel has been designed to dredge 1,000 tons per hour from a depth of 33 feet, and discharge this quantity through 3,000 feet of floating pipes over a retaining wall 17 feet high. The connections for the floating pipes can be taken from either side or one end of the vessel as required, sluice valves being fitted to suit the different connections. The pump is built up of mild steel plates, and lined on the wearing surface with special steel renewable wearing plates. The impeller is made of cast steel, with renewable blades bolted on. The pump throughout is of strong construction to withstand the heavy shocks encountered in operations of this description, and it is of the single-suction type now generally adopted in this class of work.

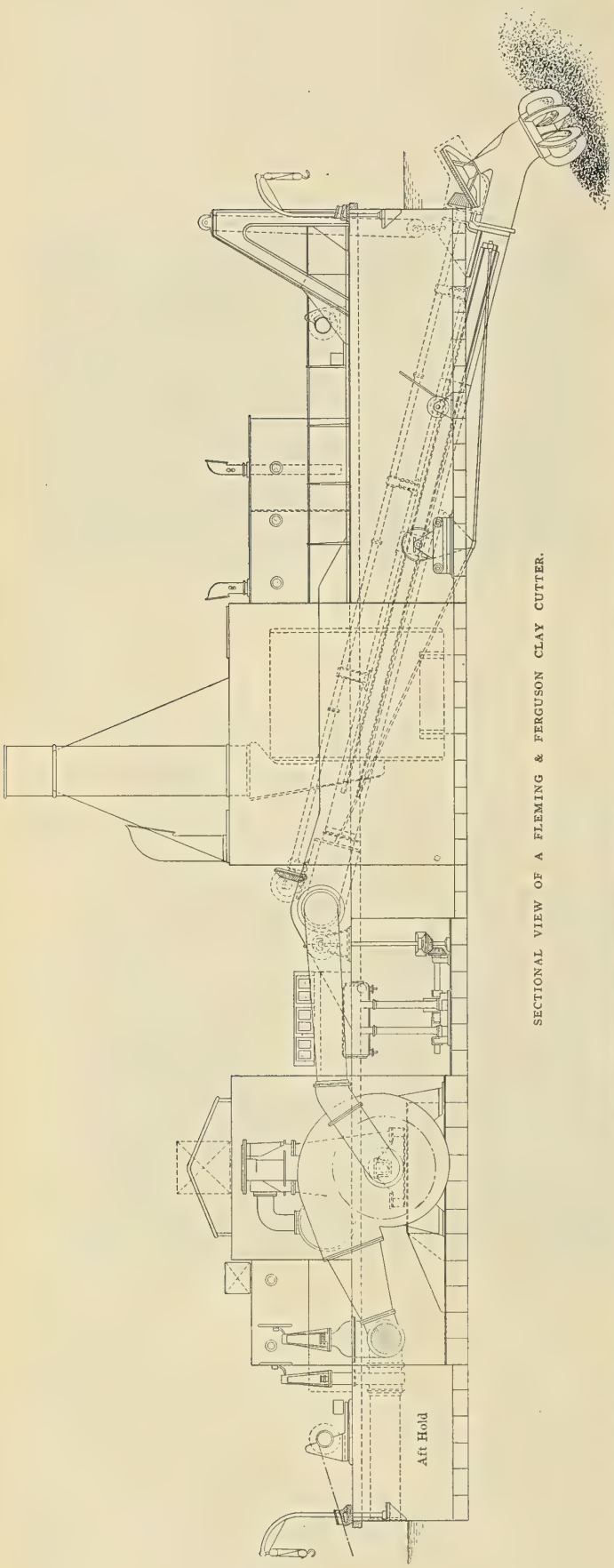
The engines for driving it are of the triple-expansion, vertical marine condensing type of 1,200 indicated horsepower. The cutter is driven by independent compound-condensing engines through gearing and shafting led along the top of the suction pipes. The suction pipe works through a center well in the vessel, and is raised and lowered by wire rope tackle connected to an independent engine placed below deck. The gear for working the engine is led to a convenient position on the deck. A complete outfit of the auxiliaries usual in this class of vessel is fitted, and steam for all purposes is supplied by two large marine boilers, constructed to Board of Trade and Lloyd's requirements for a working pressure of 170 pounds per square inch. The hull is built of Siemens-Martin mild steel plates and angles, and is riveted up to Lloyd's requirements. Special strengthening girders and doubling plates are fitted alongside the suction pipe well, and at the sides of boiler casing, in order to compensate for the large deck hatches and to withstand the shocks and vibrations consequent on the dredging operations. The watertight bulkheads extend from the keel to the deck, and sub-divide the vessel into six watertight compartments. A sliding watertight door, operated from the main deck, is fitted to the bulkhead between the engine-room and the stokehold. The coal bunkers and feed-water tanks are placed about 'midships, evenly divided athwartships, and by their positions have little effect on the trim of the vessel, although both coal and feed-water are being consumed while the vessel is in operation. Both the engine space and the boiler space are covered with deck houses, large, airy and well lighted, easy of access, and arranged generally for stability and convenience. At the fore end of the ship there are two deck cabins for the use of the officers and crew. These cabins are roofed with thick pine to resist the heating action of the sun, and have tastefully furnished living and messing accommodation. Manœuvring operations are controlled by means of three steam winches, two forward and one aft; and these, with their equipment of anchors and chains, make the handling of the vessel easy. The outfit of the anchor davits, hand pumps, steam suction piping for bilges, etc., together with holds, stores and workshop, all tend to make the vessel a high-grade plant for cutter dredging. This is the second vessel of this class built by Fleming & Ferguson, Ltd., for the Auckland Harbor Board, and the Board, being so well satisfied with the first, decided to get a larger vessel of the same type.



THE CLAY CUTTER.

New Zealand has recently been making great improvements in her harbors, and in carrying out the necessary deepening operations it has been essential to obtain a number of up-to-date dredging machines, and Messrs. Fleming & Ferguson, Ltd., have built and delivered the following: Twin-screw trailing suction hopper dredger *Eileen Ward,* built in 1910 for the Westport Harbor Board. This dredger was specially designed with heavy cast steel gravel pumps, capable of dealing with boulders up to 12 inches in diameter. She was also designed for stationary dredging. Her hopper capacity is 1,000 tons, and she is capable of loading herself in twenty minutes, rate of dredging being 3,000 tons per hour. Twin-screw stern-well bucket hopper dredger *Hapai,* capable of raising 1,000 tons material per hour from a depth of 45 feet. Hopper capacity 900 tons. This dredger is fitted with cast steel picks, to enable her to dredge rock and other hard material. Built in 1910 for the Auckland Harbor Board, New Zealand.

FLEMING & FERGUSON DREDGE FOR NEW ZEALAND.



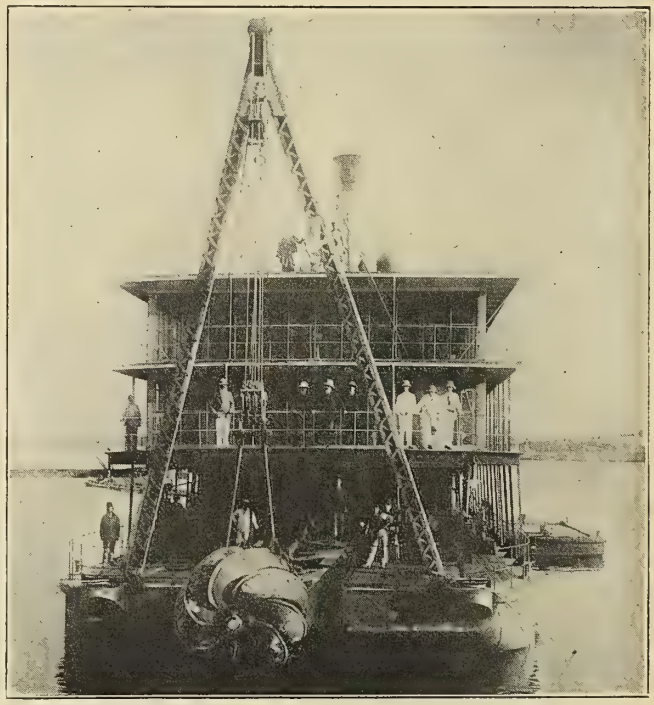
SECTIONAL VIEW OF A FLEMING & FERGUSON CLAY CUTTER.

The twin-screw combined bucket and suction dredger *Paritutu,* having the mouthpiece fitted with a rotary cutter for dealing with hard material, was built in 1910 for the New Plymouth Harbor Board, New Zealand.

Clay-Cutting, Hydraulic Dredger for the River Nile.

A vessel, or, more properly, a clay-cutting hydraulic dredge, was shipped to Khartoum from the works of Messrs. Lobnitz & Company, Ltd., of Renfrew, for the Egyptian government for service on the Upper Nile, not long since.

The dredge was designed by Mr. A. W. Robinson, M. Inst. C. E., Montreal, Can. The actual building was under the direction of the Egyptian Department of Public Works, whose adviser is Mr. C. E. Dupuis, and Mr. P. M. Tottenham, Inspector-General of Irrigation. The vessel was shipped out to Khartoum by sea and rail and there erected; being self-propelling it was able to make the voyage up the river several hundred miles to the place where work is in progress. The dredger is of the hydraulic type; it is designed to make wide cuts in the bed of the river, and to deposit the spoil on the

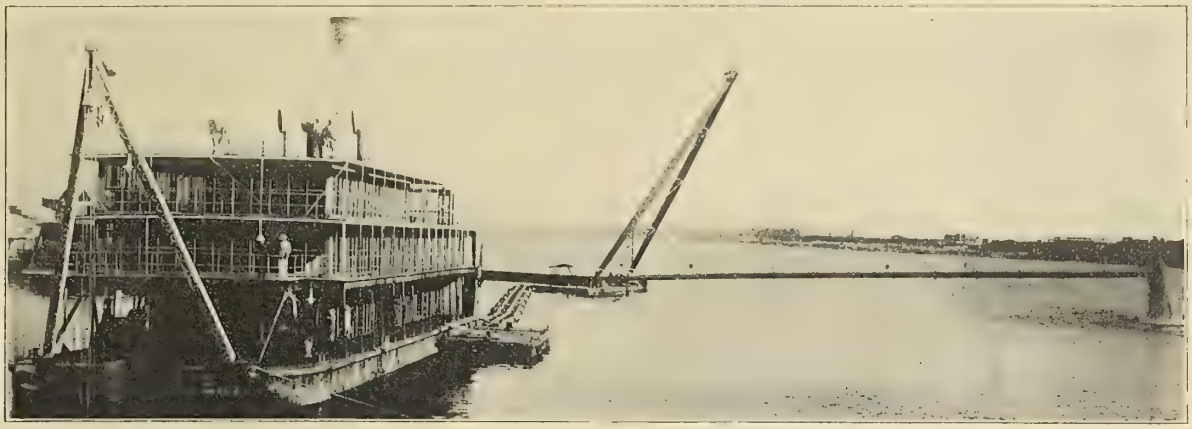


END VIEW OF LOBNITZ DREDGE.

banks through a floating pipe line having a suspended shore discharge. The hull is of steel, approximately rectangular in plan and section, 162 feet long by 38 feet beam. The machinery is mounted on the main deck and in the hold, the two upper decks being divided into accommodation for the officers and crew. A heavy steel suction frame is mounted in front, upon the end of which is fitted a powerful rotary cutter, adapted for dealing with stiff clays and heavy soils as well as softer material. The suction frame projects sufficiently in front to enable the vessel to cut its own flotation through solid ground when necessary.

Two steel spuds, or vertical anchors, are fixed in slides near the stern, each having a sharp point on the bottom, which holds in the ground and constitutes the anchorage for the vessel. The latter is caused to oscillate from one side to the other upon one or the other of these spuds as a pivot, by means of side lines carried out from the forward end and at-

tached to the shore. The cutter makes a lateral cut upon an arc of a circle, and has a clear swing from side to side of 150 feet; it can make a channel of this width by 25 feet in depth at one time. The main machinery consists of a centrifugal dredging pump driven by a triple-expansion engine of 700 horsepower, together with boilers, winches, auxiliaries, cutter-driving gear, etc., all of very complete and substantial description.



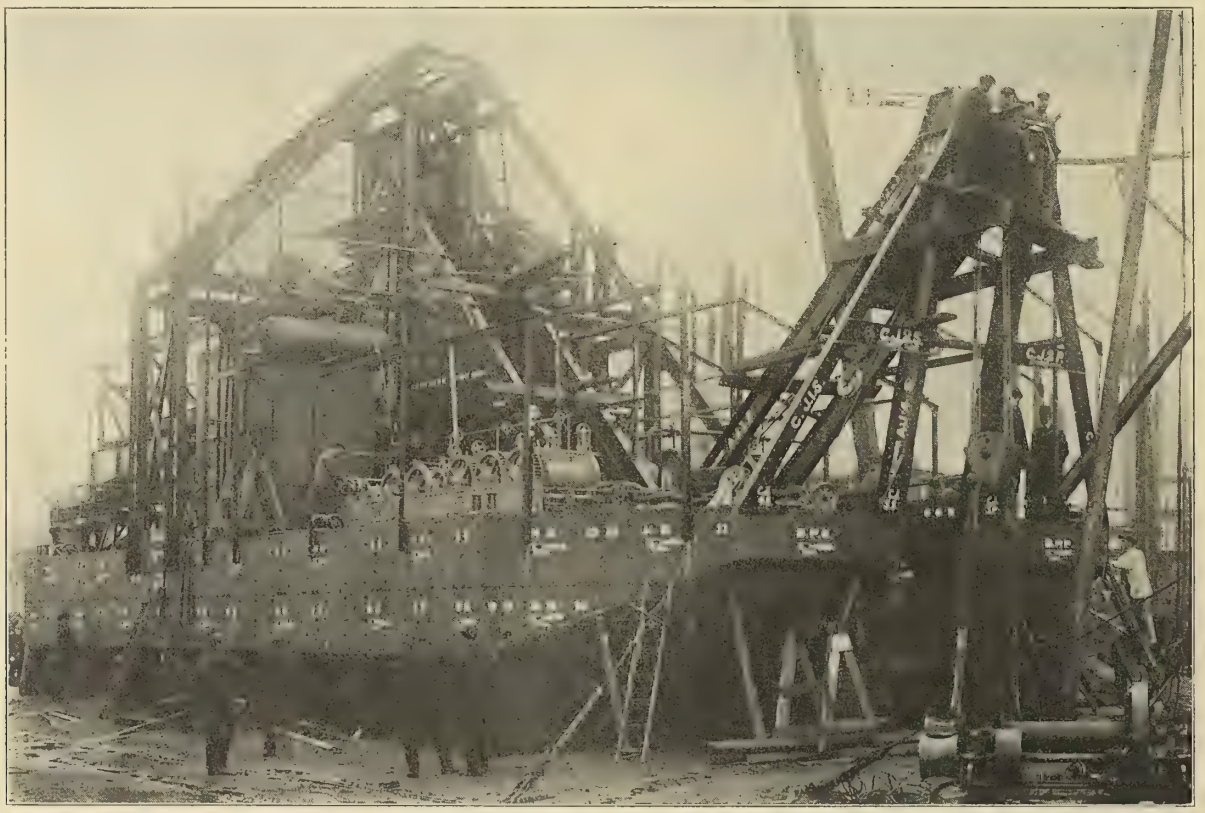
VIEW SHOWING DISCHARGE PIPE LINE.

The boilers are of the Babcock & Wilcox watertube type, and the coal bunkers are arranged amidships, so as not to alter the trim of the vessel with varying load of coal. The dredge is propelled by a stern paddle-wheel, driven by horizontal compound engines of the usual type. The underbody of the hull is shaped or cut away forward and aft to facilitate propulsion, but it is designed more for stationary dredging work than for navigation. Suitable steering gear is arranged on the upper deck forward, where are also placed the levers and signals for operating the vessel when dredging. The accommodation for

ANOTHER TYPE OF LOBNITZ DREDGE.

officers and crew is made especially roomy and comfortable. Separate decks are devoted to the native crew and the officers, each with accommodation for sleeping and dining in the open air, under double-shade decks and mosquito protection. The entire deck space of the three dredgers, and also the machinery space, are enclosed by mosquito netting of oxidized bronze, twelve meshes to the inch, in interchangeable steel frames, so arranged as to be readily removable.

The discharge pipe consists of a number of flexibly-connected floating sections and a terminal pontoon, from which the end of the pipe is suspended. The overhang of the suspended portion may be as much as 200 feet if required, so that the spoil may be put well back in marshy places. The flexible joints are of a new type, an all-metal, self-packing ball joint, avoiding the use of rubber or leather sleeves. The rotary cutter is of the Robinson improved type, and is of cast steel, with renewable cutting edges. The blades are made of special form, to cut heavy clay with as little resistance as possible, and are self-clearing. The strength of each blade is sufficient to safely withstand the strain due to encountering immovable resistances when running at full speed. This type of cutter apparatus represents the latest development of hydraulic dredging in heavy clay soils, and the success which has attended its use will have the effect of greatly extending the field of usefulness of this type of dredger, which had heretofore been thought useful only for sand or soft material. The strength and digging action of the cutter blades are fully equal to those of the buckets of the ladder type of dredger; the machine can therefore do work in any material that is adapted for hydraulic transportation through pipes equal to that carried out elsewhere by ladder dredgers.



LOBNITZ DREDGE ON THE LAUNCHING WAY.

Board of Trade Examiners.

We are informed that the Board of Trade has issued new instructions to examiners and candidates for certificates as engineers in the mercantile marine. According to these instructions, on and after Jan. 1, 1915, a candidate for a second-class engineers' certificate will be required, in addition to the present qualifications, to have served eighteen months at sea as engineer on regular watch on the main engines or boilers of a foreign-going steamers of not less than 66 nominal horsepower, or twenty-seven months in a home trade steamer of not less than 66 horsepower. A candidate for a first-class certificate must, in addition to this,

(a) have served at sea for eighteen months with a second-class certificate of competency or service on regular watch on the main engines or boilers of a foreign-going steamship of not less than 99 nominal horsepower as senior engineer in charge of the whole watch, or

(b) for 27 months with a second-class certificate of competency or service as first engineer of a home trade steamer of not less than 99 nominal horsepower, or three years with a second-class certificate of competency or service as second engineer of a similar vessel, or

(c) have served three years nine months with a second-class certificate of competency or service as third engineer of a home trade steamer of not less than 99 nominal horsepower, if during the entire period he has been the senior engineer in charge of the whole of a watch on the main engines and boilers, or

(d) possess, or be entitled to, a first-class certificate of service. There are also new instructions regarding the value, for certificate purposes, of time spent in technical and scientific training at schools recognized by the Board of Trade for the training of marine engineers.

The Boiler Accident on the Delaware.

So many wild statements have been made regarding the accident of some weeks ago to one of the boilers on board

the battleship *Delaware* that we publish the following abstract of the finding of the Court of Inquiry held by the Navy Department:

Three rear headers, Nos. 8, 9 and 10, were blown bodily out of the boiler (a Babcock & Wilcox).

The headers were severely bowed, their tube faces bulged, and the metal showed signs of overheating. All the back headers of the outboard half of the boiler, 13 in number, were more or less bowed.

The 4-inch tubes next the fire were all more or less bowed near the back ends, and showed signs of having been burned; and the majority of the 2-inch tubes were more or less distorted, while a number showed signs of having been white hot.

The superheater tubes and manifolds showed a red color, and the 4-inch tubes through the first and second passes showed the blue color characteristic of overheating.

On two of the headers blown out were found scores and dents made by striking obstructions. The character of the scores and dents, and the blue color of the metal in the scores, indicated that the metal was in a softened condition, due to heat, when they struck.

From a consideration of all the facts presented, the court concluded that the explosion was due to the lack of a sufficient quantity of water in the boiler, and that the water-tender on watch at the time was responsible for this condition.

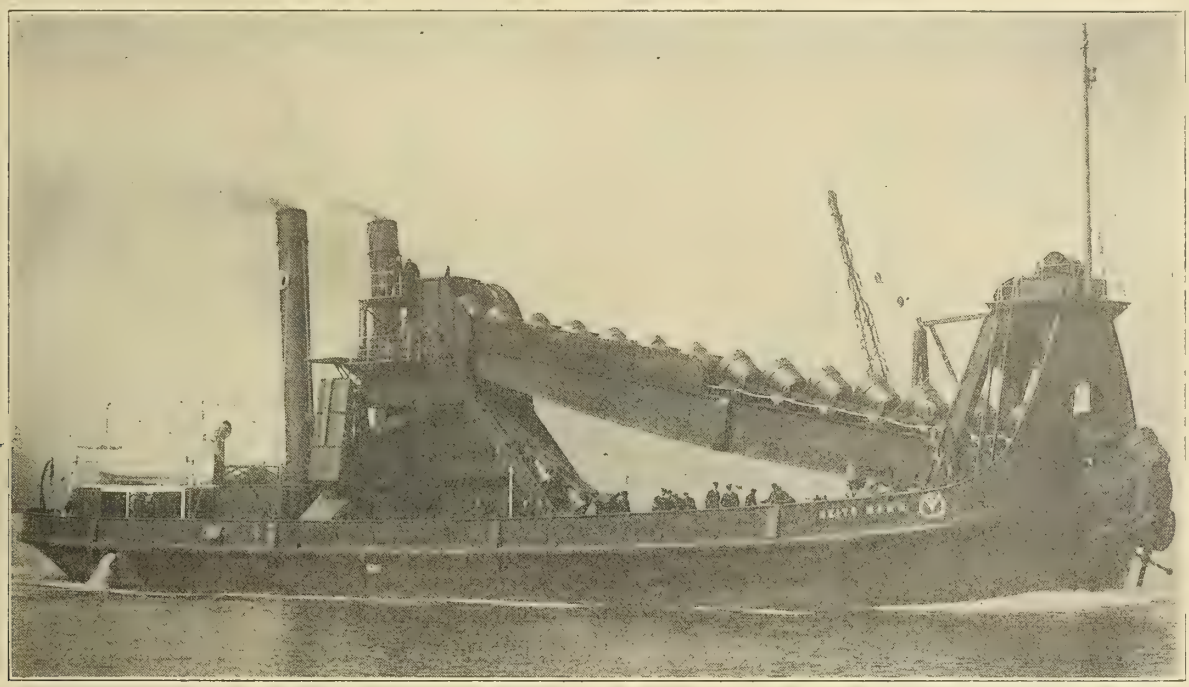
The so-called explosion could not have been very serious, as the captain, who was on deck at the time, did not even know that an accident had occurred until it was reported to him. In other words, the explosion did not make sufficient noise to attract attention on the upper deck.

Bucket Dredger "Heito Maru."

Heito Maru, built by Messrs. Ferguson Bros., of Port Glasgow, is of the bow-well center-bucket ladder type, and is capable of raising 1,000 tons per hour from a depth of 46 feet. She is built to Lloyd's highest class. Side chutes are arranged for discharging the dredged material over either side into hopper barges, the lifting and lowering of each chute being worked by an independent steam engine. The main engines are employed for either propelling or driving the dredging gear. There are two speeds of gearing, to enable the buckets to be worked at different speeds according to the nature of material being dredged. Two large multi-tubular boilers supply steam to the various engines. The lifting and lowering of the bucket frame are controlled by an independent double-cylinder engine, working the builder's latest improved type of hoisting gear. The accommodation for the officers and crew is fitted forward, and is commodious and handsomely finished. Electric light is fitted throughout.

Suction Hopper Dredge St. Lawrence.

Messrs. William Simmons & Company, Ltd., Renfrew, have constructed a Simons patent cutter suction hopper dredger named the *St. Lawrence*, to the order of the Director of Works of the Admiralty. The *St. Lawrence* is of 2,000 tons hopper capacity.



FERGUSON BROS. DREDGE HEITO MARU.

Her arrangements are as follows: An independent set of triple-expansion engines for driving the dredging pump, with a complete installation of auxiliary machinery, is fitted in a separate engine-room immediately in front of the hopper compartment. Steam for the propelling and pumping engines, and all machinery throughout the dredger, is supplied by three marine type steel boilers. The dredging pump is of the most massive and powerful description to withstand the shocks which may be sustained when dredging in clay mixed with stones. The suction pipe is carried on a girder led through a well forward, and is of sufficient length to enable dredging to be done at a depth of 65 feet below waterline. The dredger is designed for cutting its own flotation. The cutter at the mouth of the suction pipe is driven through a line of shafting, fitted on upper side of suction frame, and machine-cut steel gearing actuated by a set of powerful, independent compound-condensing engines. In addition to the usual winches for mooring from the deck at bow and stern, a special winch is placed amidship, from which the moorings are led along the suction frame to fairleads at lower end.

The hopper is fitted with Simons patent arrangements,

whereby the contents of the hopper can be discharged either through the doors in the ordinary way or over side by the pump for land reclamation. In addition to loading into its own hopper the vessel is arranged to discharge into barges moored alongside or through a pipe line. Two sets of triple-expansion surface condensing engines are fitted aft for propelling the vessel at a speed of 10 knots per hour. The auxiliary machinery in the propelling engine room is of the most up-to-date character. The results obtained with the *St. Lawrence* at Portsmouth have been in every way satisfactory. It is stated that the *St. Lawrence* results, in stiff clay, are quite double those obtained by bucket dredgers.

At the present moment Messrs. William Simons & Company, Ltd., are constructing another Simons patent cutter suction hopper dredger to the order of the High Commissioner for the Union of South Africa. This dredger, which is practically of the same size and capacity as the *St. Lawrence*, will be employed in the improvement of the depths of the bay at Durban.

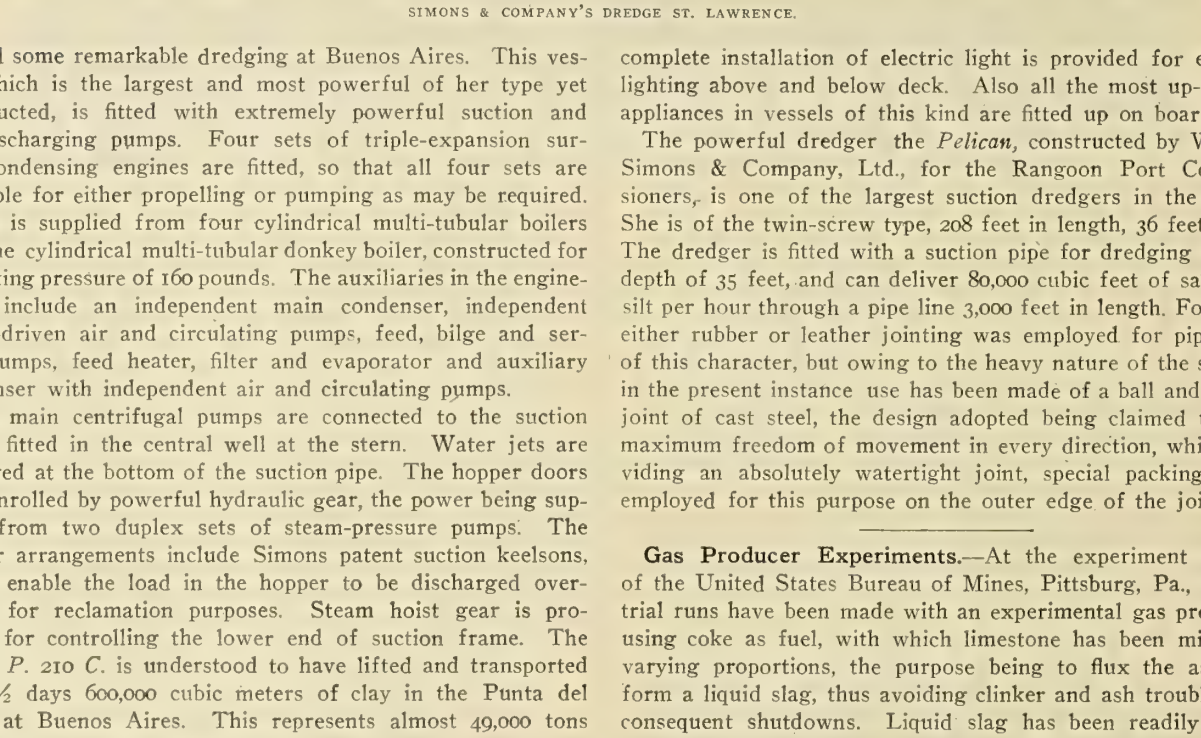
DREDGER "M. O. P. 210 C."

The dredger *M. O. P. 210 C.*, constructed by William Simons & Company, Ltd., to the order of the Argentine government is of the trailing suction hopper type, and has accomplished some remarkable dredging at Buenos Aires. This vessel, which is the largest and most powerful of her type yet constructed, is fitted with extremely powerful suction and self-discharging pumps. Four sets of triple-expansion surface-condensing engines are fitted, so that all four sets are available for either propelling or pumping as may be required. Steam is supplied from four cylindrical multi-tubular boilers and one cylindrical multi-tubular donkey boiler, constructed for a working pressure of 160 pounds. The auxiliaries in the engine-room include an independent main condenser, independent steam-driven air and circulating pumps, feed, bilge and service pumps, feed heater, filter and evaporator and auxiliary condenser with independent air and circulating pumps.

The main centrifugal pumps are connected to the suction frame fitted in the central well at the stern. Water jets are arranged at the bottom of the suction pipe. The hopper doors are conrolled by powerful hydraulic gear, the power being supplied from two duplex sets of steam-pressure pumps. The hopper arrangements include Simons patent suction keelsons, which enable the load in the hopper to be discharged overboard for reclamation purposes. Steam hoist gear is provided for controlling the lower end of suction frame. The *M. O. P. 210 C.* is understood to have lifted and transported in 21½ days 600,000 cubic meters of clay in the Punta del Indio at Buenos Aires. This represents almost 49,000 tons dredged and discharged per day.

Among the dredging vessels now under construction by William Simons & Company, Ltd., is a very powerful twin-screw, 1,200-ton hopper dredger, to the order of the Isthmian Canal Commission. This dredger, which will be employed in doing some of the very hardest cutting in the Canal Zone, is fitted with two sets of dredging buckets—one set for clay and one for mud. This dredger will be capable of cutting its own flotation and dredging to a depth of 50 feet below the light waterline when the ladder makes an angle of 45 degrees with the vertical. The dredger is designed to discharge either direct into its own hoppers or into barges alongside. The dredging gear is arranged to give two different speeds of buckets per minute with a constant piston speed of engines, so that the full power of the engines is exerted whether the vessel is working on hard or soft ground.

Two steel cylindrical multi-tubular boilers will be fitted on board; either boiler is capable of supplying steam to the engines and all auxiliaries when at full work. The two sets of propelling engines, which are of the triple-expansion surface-condensing type, are of sufficient power to drive the vessel at a speed of 10 knots per hour. Powerful independent winches are fitted at bow and stern for manœuvring the dredger while dredging, and for raising and letting go anchors, etc. Hopper doors are controlled by hydraulic power. A complete installation of electric light is provided for efficient lighting above and below deck. Also all the most up-to-date appliances in vessels of this kind are fitted up on board.



SIMONS & COMPANY'S DREDGE ST. LAWRENCE.

The powerful dredger the *Pelican*, constructed by William Simons & Company, Ltd., for the Rangoon Port Commissioners, is one of the largest suction dredgers in the world. She is of the twin-screw type, 208 feet in length, 36 feet beam. The dredger is fitted with a suction pipe for dredging from a depth of 35 feet, and can deliver 80,000 cubic feet of sand and silt per hour through a pipe line 3,000 feet in length. Formerly either rubber or leather jointing was employed for pipe lines of this character, but owing to the heavy nature of the service, in the present instance use has been made of a ball and socket joint of cast steel, the design adopted being claimed to give maximum freedom of movement in every direction, while providing an absolutely watertight joint, special packing being employed for this purpose on the outer edge of the joint.

Gas Producer Experiments.—At the experiment station of the United States Bureau of Mines, Pittsburg, Pa., several trial runs have been made with an experimental gas producer, using coke as fuel, with which limestone has been mixed in varying proportions, the purpose being to flux the ash and form a liquid slag, thus avoiding clinker and ash troubles and consequent shutdowns. Liquid slag has been readily made, which runs freely from the producer. The high temperatures necessary are very efficient in the generation of gas.

A Hydraulic Pipe Line Dredge.

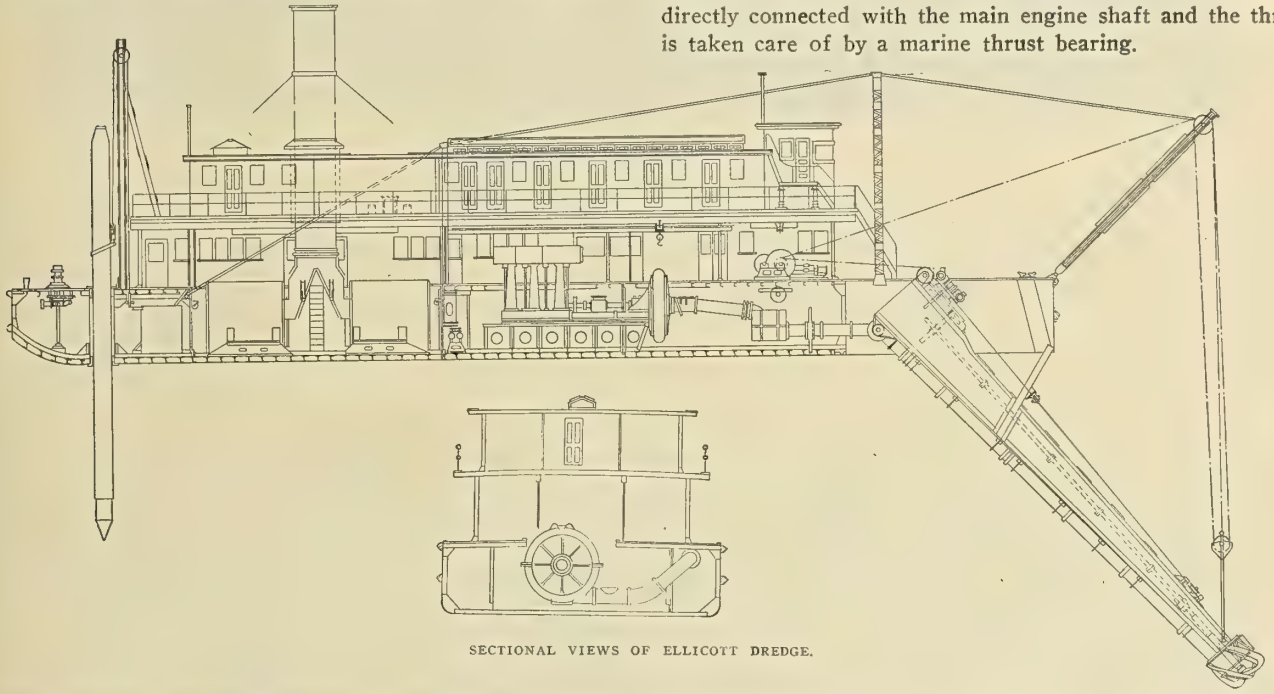
The dredge illustrated and described herein was recently constructed by Ellicott Machine Company, of Baltimore, Md., for the Isthmian Canal Commission for work on the Isthmian Canal.

The dredge is of the cutter type with a single sand pumping outfit. The pumping machinery consists of a centrifugal pump directly connected to a triple expansion engine. The material to be dredged is loosened or agitated by a revolving cutter. The feeding into cut is by means of wire rope haulage on each side of bow with pivoted stern and the advance forward is accomplished by two spuds. The steam plant consists of four boilers of the Scotch type built to meet marine requirements for a pressure of 200 pounds per square inch.

General Dimensions.

Length overall	150 feet.
Beam moulded	40 feet.
Extreme depth of hull	10 feet 6 inches.

In service the dredge has demonstrated a capacity, under ordinary service conditions, in excess of 750 cubic yards per hour, place measurement. At present, it is operating through a pipe line 7,000 feet in length dredging coral sand and coral rock. The aggregate indicated horsepower of this machine under ordinary conditions of service is approximately 1,000 horsepower.



SECTIONAL VIEWS OF ELLICOTT DREDGE.

Hull.—The hull is constructed throughout of steel and is divided into four water tight compartments by means of three transverse bulkheads and is strengthened by two fore and aft bulkheads running throughout the whole length of the dredge. The main engine and pump foundations and the foundations for certain parts of the auxiliary machinery are built of steel and so designed as to insure the greatest possible stability. Side lights are provided at frequent intervals on the sides of the hull to give light below the main deck in the day time. Marine coal scuttles and hatch openings are provided on the main deck.

Superstructure.—The superstructure is of wood throughout. It consists of a house over the main deck covering all parts of the machinery. The living quarters are above the main house. These consist of a pilot house at the forward end of which are located levers for operating all machinery except the main engine, throttle valves, etc., so that the operator has full control from this point. The living quarters are located aft of the pilot house and are commodious and comfortable. All door and window openings are provided with bronze screens and slatted sliding blinds. The staterooms of the captain and chief engineer are located immediately behind the pilot house, with bath room between. Aft of this is located the officers' mess room with staterooms for the various subordinate officers arranged on either side. Next follows the galley with refrigerator room and two pantries opening into the galley. The crew's mess room is next aft of the galley and the crew's quarters are at the extreme end of the upper house, arrangements being made for separate cabins for the firemen and deck hands, each cabin being equipped with showers and lavatories.

Pumping Machinery.—The pumping machinery consists of a centrifugal pump of the side suction disc lined type constructed throughout of steel and especially designed to withstand shocks and abrasion due to the passage of stones, gravel and sand and with very large openings to admit of the passage of solid bodies without obstruction. The pump is directly connected with the main engine shaft and the thrust is taken care of by a marine thrust bearing.

Main Pumping Engine.—The main pumping engine consists of a three-cylinder, triple-expansion vertical fore and aft condensing engine.

Agitating Machinery.—At the bow of the dredge is located a steel ladder or framework resting on heavy steel trunnions which are an integral part of the hull. The depth of cut is regulated by raising and lowering the outer end of this ladder, which is designed to dig to a depth somewhat in excess of 40 feet. The suction pipe is carried by the ladder and extends to the outer end, where it passes inside of a revolving cutter. The cutter is of the spiral type, constructed of steel, and is driven by a shaft through cut steel gearing.

Agitating Engine.—The agitating engine is mounted directly on the ladder at its inboard end. It is a double condensing engine especially designed to bear constant shocks and jars incident to the work which it has to perform. The crank pins, guides, bearings, and in fact every feature of this engine, are especially designed to meet unusual conditions of service.

Hauling Machinery.—The hauling machinery consists of a double reversible condensing engine operating through cut

steel gearing a lay shaft which runs transversely across the deck. All drums are operated from this shaft by means of steel gearing with suitable clutches and brakes, one drum being used to raise and lower the ladder, two drums to operate the wire ropes by which the dredge is swung transversely back and forth across the cut and two drums are used in lifting the spuds which are located at the stern of the dredge. The transverse shaft carries gypsy heads on either end for breasting purposes and in addition a steam capstan at the stern.

the various connections are taken and with means to haul out the strainer and clean it without docking the boat. In addition to these auxiliaries, the following are located also in the engine-room: Salt water and fresh water pumps for plumbing and sanitary uses, jet pumps for circulating water to various bearings, filter box, heater, grease extractor and other marine fixtures such as gage-boards, wrench-racks, etc.

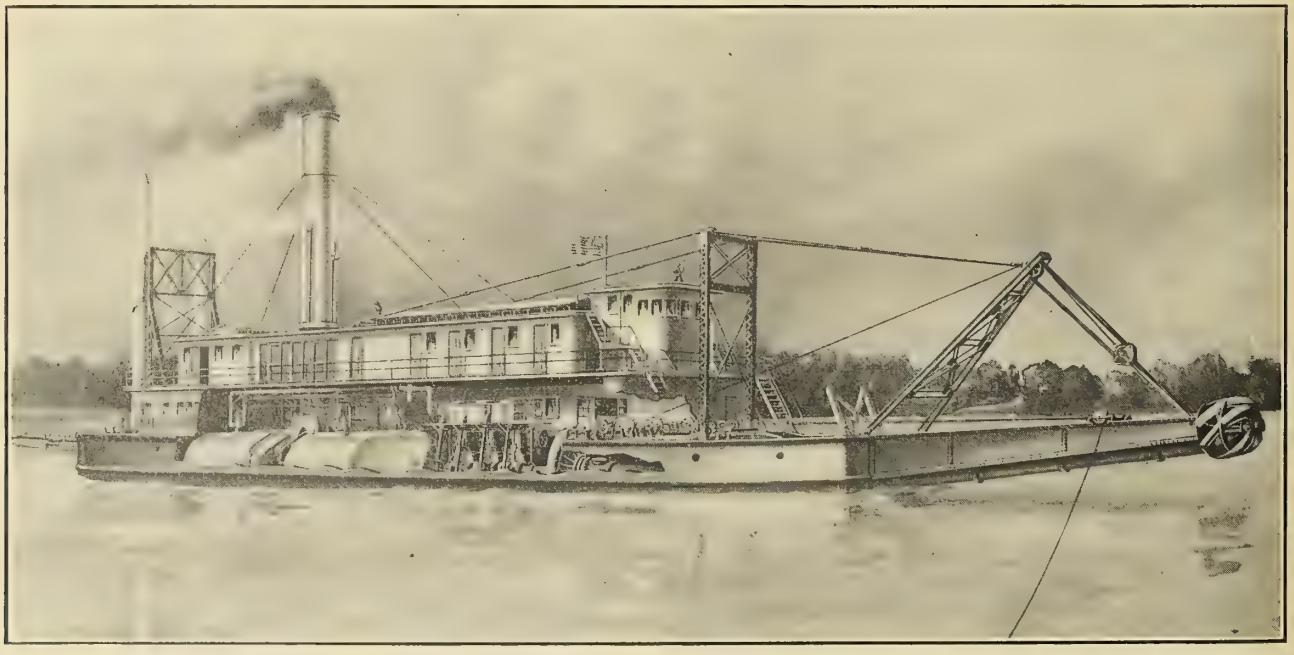
Pump Room.—The pump room is located forward of the engine room and the main dredging pump is located therein,

THE BROWN SELF-PROPELLED HOPPER DREDGE.

Boiler Plant.—The boiler plant consists of four wet back Scotch marine boilers built under marine rules for a working pressure of 200 lbs. per square inch and are so proportioned that the dredge may be operated under ordinary conditions of service with three boilers, leaving one as a spare. Provisions are made with oil tanks and coal bunkers so that the dredge may be operated either with fuel oil or coal, the fire-room being of ample size and convenient arrangement.

separated from the engine room by a water tight bulkhead. This room contains, in addition to the main pump, a stone box of ample size and quick closing valve on the main suction pipe. The fire pump is also located in this room and in addition to operating the fire service is used in connection with the operation of an improved ash ejector.

Ice Plant.—The refrigerating machinery is located in the after end of the lower house. It is provided with ice cans



VIEW SHOWING MACHINERY IN THE ELLICOTT DREDGE.

Engine-Room.—The engine-room outfit is of the most modern type of marine construction. The condenser is of the surface condensing type with independent air and centrifugal circulating pump. Feed pumps are in duplicate, of outside plunger type. Special arrangements are made to prevent obstruction of sea connections by a central supply from which

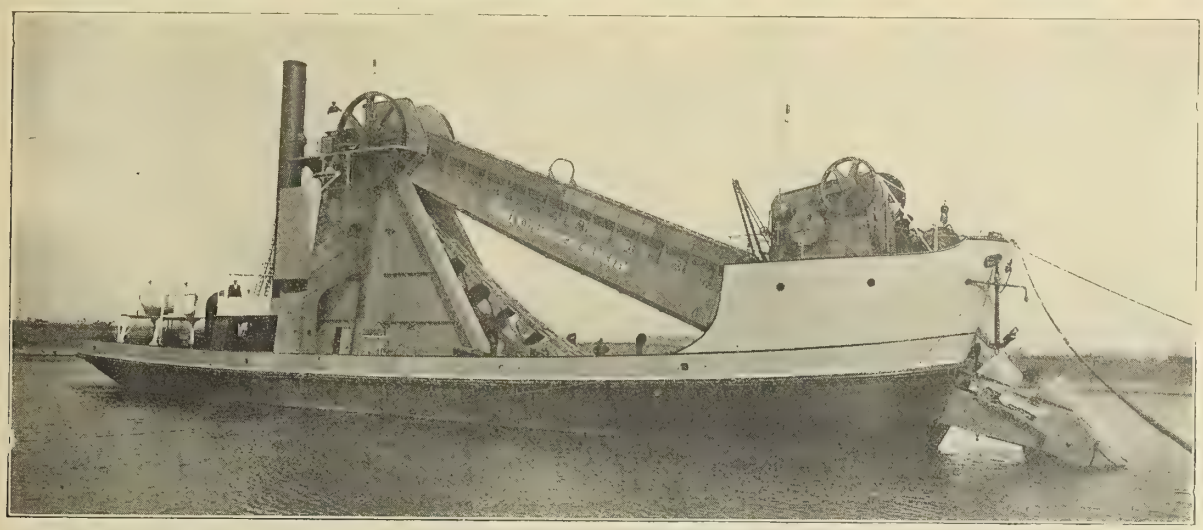
for making ice, a scuttle-butt for drinking water and also cools the main refrigerator, which is located on the upper deck.

Electric Plant.—An electric plant is provided by means of which the whole interior of the dredge is lighted and in addition a searchlight operated from the pilot-house and arc

lights at the bow and stern, the wire being principally in conduits. A convenient traveling crane is located on the main deck and is of suitable capacity to handle all parts of the main pump and any part of the engine room and pumping machinery. Since the construction of this dredge, two machines of equal capacity have been constructed by this firm, one of which is working in the harbor of Havana, Cuba, having been purchased by the Huston-Trumbo Dredging Company, of Havana, and the other being purchased by the United States Government for the harbor of Mobile, Ala.

A Self-Propelled Grab-Crane Hopper Dredge.

The *Owenaminaue,* constructed by Messrs. George Brown & Company, of Greenock, is a very useful vessel for dredging rivers. She is of the grab-crane hopper type and is self-propelling. The crane grabs work at a depth of 50 feet, and lifts at 30 feet depth 160 tons per hour. The hopper has a capacity of 420 tons, and the vessel when loaded can proceed to sea at a speed of 7½ knots per hour. The propelling machinery is a compound surface-condensing engine, and the boiler is the marine type, having ample capacity to work both cranes or main engines. The cranes were supplied by Messrs. Clarke, Chapman & Company, Ltd., Gateshead, the grabs being Priestman single-chain type, arranged to work through a specially designed ball-bearing swivel attached to a wire rope on crane instead of the usual chain. The hopper doors are of two thicknesses of wood, hinged to a main fore and aft girder, and are slipped by a simple trigger arrangement on the side combings of the hopper, being closed independently by a rope led to the windlass or after capstan. The vessel is classed 100 A-1 by Lloyds, and was built under their special survey.



DREDGE ADELAIDE, BUILT BY SMULDERS.

Sea-Going Bucket Dredger Adelaide.

The powerful seagoing bucket dredger *Adelaide* was built by "Werf Gusto," A. F. Smulders, of Schiedam, Holland, for the South Australian government. The apparatus is specially intended to dredge very stiff clay. Her main dimensions are the following:

Length	161 feet.
Breadth	34 feet 6 inches.
Depth	13 feet.

This dredger, which has been built in conformity with Lloyd's rules, Class 100 A, and under special survey, is provided with a compound main engine of 500 indicated horsepower, which works either the screw, while navigating, or the dredging apparatus. She is further fitted with the following machinery for auxiliary service: One compound engine of 150 indicated horsepower for working the fore and aft winches and the ladder-hoisting winch. A special steam engine for working the independent condenser which takes the exhaust steam of the main and auxiliary machinery. A steam engine working a centrifugal pump which supplies water to the chutes in order to facilitate the sliding of the dredging in the chutes, some kinds of clay being very sticky. A steam engine for driving the dynamo, by means of which the vessel is lighted electrically throughout. Steam for the above-named engines is supplied by two multi-tubular marine boilers, having each a heating surface of 980 square feet and working at a pressure of 120 pounds.

In view of the fact that this dredger will have to deal with soil of extraordinary toughness, the dredging apparatus has been very strongly designed. Instead of being formed by four legs only, as is usual, the main framing, carrying the upper tumbler with shaft and toothed wheels and the dredging ladder, consists of six heavy beams, of which three are at port and three at starboard side, the two aft beams of each side being, moreover, mutually connected by means of strong girders In order to give an idea of the dimensions, it may be stated here that each of the large cast steel toothed wheels which drive the upper tumbler has a diameter of not less than 16 feet, whereas the weight of the upper tumbler, with its shaft and two beveled wheels, aggregates 21 tons. The power of the main engine is carried to the upper tumbler by means of a very substantial transmission of the fixed type, consisting of strong cast steel toothed wheels and a heavy, vertical shaft fitted inside the main framing. This transmission is provided with a friction brake, which disengages automatically the connection between the engine and the dredging apparatus as soon as the buckets, at any given moment, strike upon a submarine rock or any other object that offers too great a resistance to be safely dredged. This prevents the bucket chain or the transmission wheels from being broken by some violent shock that might suddenly stop the bucket chain. Instead of being provided with separate steam engines, directly fed by the boilers, the fore and aft winches as well as the ladder hoisting winch are worked by a single steam engine, placed in the engine-room, by means of cast steel gear wheels driven by shafting extending over the whole length of the vessel, including the raised fore-deck.

This dredger, which has been christened *Adelaide,* after the name of the port she is intended for, is capable of excavating to a depth of 43 feet below waterline. The buckets have a

capacity of 21 cubic feet, the front being made out of a steel plate of heavy section, provided with cutting lip, whereas the bottom and back consist of a single piece of cast steel. The contract provided for a navigating speed of 7 knots per hour and an effective output of 500 cubic yards per hour when dredging stiff clay. During official trials she has steamed 8 knots, and has easily raised 630 cubic yards of hard clay in one hour, *i. e.,* 130 cubic yards per hour in excess of the output contracted for. The *Adelaide* made the voyage to Australia under own steam in seventy-eight days, a trip of 11,000 miles. Taking into account that she had to call at several ports for coaling purposes and that she had to struggle with a violent monsoon in the Indian Ocean, this may be considered a splendid performance for a bucket dredger.

Twin-Screw Bucket and Suction Dredger Hsin-Ho.

The "Werf Gusto" of Messrs. A. F. Smulders, Schiedam, Holland, have built a twin-screw combined suction and bucket dredger, the *Hsin-Ho,* for the Chinese government to use at Tientsin. This dredge is able to cut her own flotation and to discharge the spoil into barges alongside or through a floating pipe line of a diameter of 20 inches and a length of 1,000 feet, to a height of 9 feet above water level, when dredging either by the suction apparatus or by the bucket chain. The main dimensions of the vessel are:

Length between perpendiculars...	157 feet 6 inches.
Breadth	36 feet 9 inches.
Depth	11 feet 6 inches.

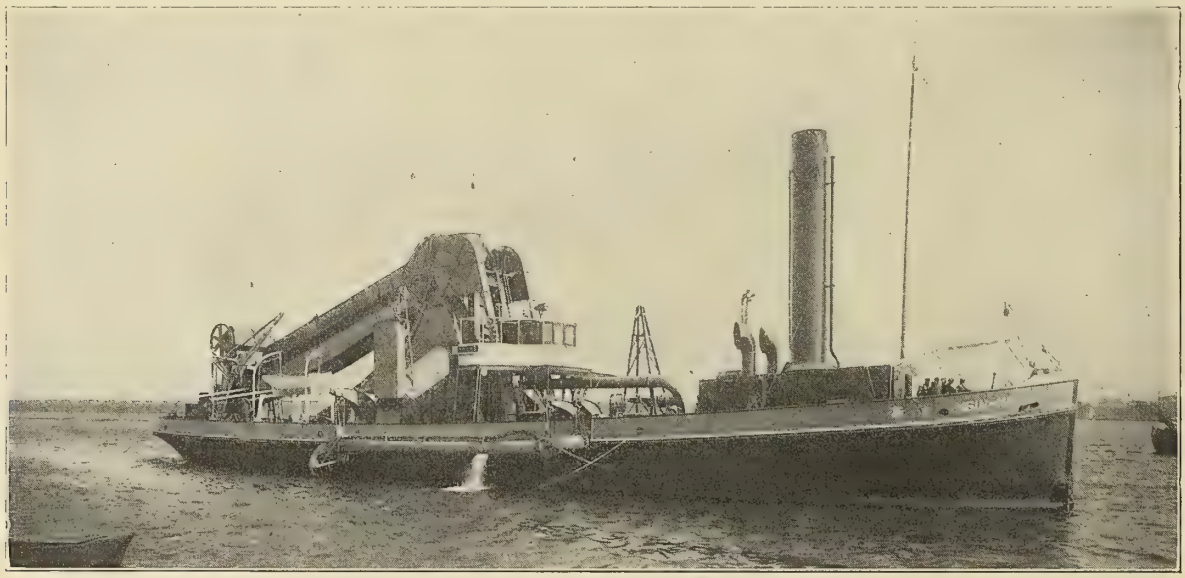
The dredging depth of the *Hsin-Ho,* when dredging by suction or by means of the bucket chain with the ladder at 45 degrees, is 26 feet. Her theoretical output is 650 cubic yards per hour. With the bunkers filled with coal, water in tanks and boilers, the vessel being in full working order, her maximum draft is 6 feet 6 inches. The mean speed, when normally equipped, is 8 knots. The main engines are two in number. They are of the inverted type, compound, steam-jacketed, with surface condensers, and are designed to develop 320 indicated horsepower each. When the engine driving the bucket chain runs at 140 revolutions a minute, the bucket chain has to attain a speed of fourteen buckets per minute. During trials, however, sixteen buckets per minute were easily carried over the upper tumbler. The capacity of the buckets is 21 cubic feet. An auxiliary engine works the dynamo which supplies electric light. The two main boilers are of the multitubular return-tube type, and have a heating surface of 1,380 square feet each and a working pressure of 120 pounds per square inch.

The *Hsin-Ho* is capable of performing the following dredging operations:

1. Dredging by means of the bucket chain and discharging directly into barges moored at either side. When working in this manner one of the main engines remains inactive.

2. Dredging heavy soil by means of the bucket chain and pressing it away through the floating pipe line, which is connected to the vessel's stem at water level. One of the main engines works the bucket chain and the water pump, while the second engine drives the force pump. Inside the main framing has been placed the spoil receiver, provided with a grating through which the spoil has to pass before reaching the force pump. Here the stones are removed by a set of rotating knives, whereas the big lumps of soil are cut up by a powerful jet of water supplied by a special high-pressure pump. The force of this water jet acts upon the spoil like a knife and forces it down through the bars of the grating.

3. Dredging as described above, but raising light instead of heavy soil. In this case the water pump and the sand pump may be coupled for working compound. The water pump, acting as a sand pump, sucks up the spoil out of the receiver, and passes it on to the sand pump proper, which forces it away through the pipe line. One of the main engines then works the bucket chain and the suction pump, the second engine driving the force pump.



THE SMULDERS DREDGE HSIN-HO.

4. Sucking from the bottom, while navigating, by means of the starboard trailing suction pipe and discharging the spoil into barges moored at portside. A special high-pressure centrifugal pump is provided for working the nozzle-stirring arrangement fitted at the mouth of the suction pipe. When working in this way, one of the main engines drives the starboard screw and the suction pump, the other engine actuating the portside screw only.

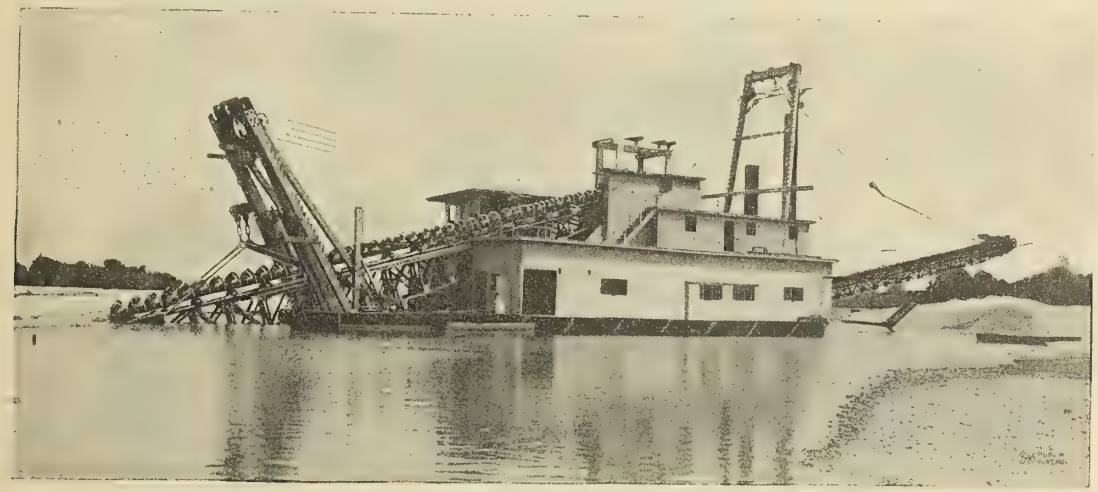
5. Sucking from the bottom while at anchor and discharging into barges or through the pipe line. When pressing through the pipe line, the pumps may be coupled as described, each engine driving one pump.

The *Hsin-Ho* made the voyage to the Far East under her own steam.

Gold Dredging by Electricity.*

BY H. W. ROGERS AND C. M. BLIVEN.

Dredging is the most recent of mining methods employed for recovering values in auriferous ground located below the water level or in streams where the flow of water is too great to admit of success by other means. That it has attained an important place in the industry is evidenced by the fact that, although the first successful dredge in California only began operations about ten years ago, to-day more than one-quarter of the gold mined in that State is secured by the dredging process, and the bulk of this is obtained from grounds previously mined. The development of the gold dredge affords one of the most interesting chapters in the history of mining. It is the latest of a series of successive steps in the recovery of placer deposits, following the pan, the rocker, the long Tom, the sluice box, the ground sluice, drift mining, the monitor and the hydraulic elevator. All of these methods had their time and place, and some are extensively employed to-day, but it remained for the dredge to solve the problem of mining in grounds below the water level and in rapidly flowing streams.



GENERAL ELECTRIC GOLD DREDGE AT WORK.

Rich deposits of auriferous earth lying below the water level in the valley of the Feather River in California led to the introduction of the machine and the establishing of this industry. The gravels had already been mined to the water level, and the wealth yielded is still a legend of the days when "hundred dollars (20 pounds) a day diggings" were not uncommon. For half a century men had striven to find a means of reaching the lower stratum, but without avail, for the water drove them back. When the dredge finally came it followed closely and was, in large part, due to an attempt to mine with the aid of powerful pumps, which, although inadequate, were suggestive of a more highly satisfactory method. The development, however, has had its failures as well as its successes, for, be the machine ever so perfect, it must fail unless it works in ground that contains gold in sufficient quantities to be profitable and where conditions are favorable for the successful recovery of the metal. Ideal dredging ground is of limited depth with a soft bed rock, free from large boulders, and with values evenly distributed. Where these conditions are combined, dredging for gold may be a profitable industry.

The early type of dredge, which was considered massive and powerful, is a striking contrast to the dredges of the present day. It was equipped with three and one-fourth cubic foot buckets, digging to a depth of 30 feet, and was driven by a 50-horsepower steam engine; and, although partially successful, was always very expensive, owing to the scarcity of fuel and the excessive cost of handling it.

With the rapid development of hydro-electric plants throughout the West, and the insurance of a continuous, economic power supply transmitted through great distances, the mining companies soon turned their attention to the electric motor for operating dredges.

The most successful and practical standard dredge of to-day is the continuous-chain, close-connected bucket type, varying in capacity from 3 to 13½ cubic feet. While the details may vary slightly, in general construction it is similar to the ordinary continuous chain-bucket dredge used for other work, except that it must be greatly strengthened in order to resist the excessive strains due to digging in rocky ground. The machinery consists of the digger or bucket line, revolving screens, sluice tables and boxes, stacker for carrying the tailings, high and low-pressure pumps, priming pumps, amalgamator, lines and spuds for guiding the dredge, and occasionally a sand pump.

DIGGER.—The digger consists of a steel ladder of massive construction, built to support the bucket line and resist the heavy strains while in operation, especially near bed rock. The bucket lips, bushings and rollers are made of manganese steel, which possesses the best wearing qualities and reduces the cost of maintenance to a minimum. The speed of the bucket line varies from 50 feet (with 18 to 25 buckets) to 75 feet (with 35 to 50 buckets) per minute, depending upon the condition of the ground. For the operation and control of the digger, a variable speed motor is used. This is located on the lower deck and belted to the driving pulley, which is generally situated in the rear of the pilot-house on the upper deck. The duty imposed upon this motor is severe, as it must operate under conditions calling for power varying from 75 percent overload down to 25 percent of its rated capacity. The motor recommended for this service is an alternating-current, induction-type machine, known as Form M, designed on liberal lines and equipped with a drum-type controller having fourteen running points, forward and reverse, with the necessary resistance for continuous operation on any notch of the controller from one-half to full speed. The maximum starting torque is required and obtained at about the fourth point of the controller, thus leaving three points on which to bring the motor up to half speed, at which time nearly full-rated torque is required. As a result of these conditions, the ordinary motor designed for intermittent service cannot be successfully applied.

WINCH.—To keep the dredge in place and to move it about or hold it against the bank when digging, head lines are used,

* Abstract from *General Electric Review*, January, 1911.

which are controlled from the forward end and operated by a six-drum winch driven by a variable speed motor. The winch motor, while of smaller capacity, is of the same staunch construction as the digger motor, and is equipped with a suitable controller and resistance to permit its continuous operation at from one-half to full speed. It has been found advisable to equip the motors for this service with solenoid brakes, by means of which the motor can be brought to a standstill almost instantly. It is then ready for the reverse operation without the usual reversing of the motor through the controller, which is not only bad practice but may result in a burnout, due to the heavy strain on the windings.

Pumps.—The high and low-pressure pumps for supplying water to the screens and sluices are generally connected to the same motor. A constant-speed Form K motor of compact construction and large overload capacity, with a speed of about 900 revolutions per minute, is usually installed for this work, and is supplied with extended shaft at both ends, these extensions being provided with flange couplings for direct connection to the pumps. The standard General Electric Form K constant-speed motor is recommended for use throughout the dredge, except on the digger and winch.

Sand Pump.—To prevent the filling up of the basin in which the dredge floats, when digging in shallow water, it is sometimes found necessary to install a sand pump, which carries the fine tailings from the sluice boxes to the top of the rock pile by way of the stacker. This pump requires considerable power and is never used unless absolutely necessary.

Priming Pump.—This pump is used for priming the large pumps or for supplying water to the tables during the "clean up," and generally consists of a small, high-speed motor direct connected to a centrifugal pump.

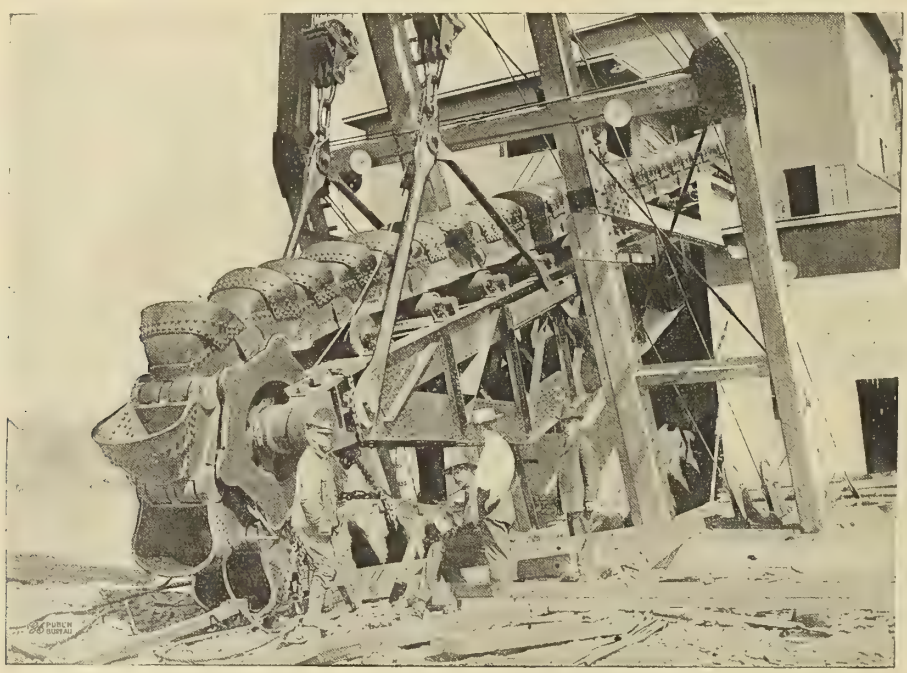
Screens.—Either the shaking or revolving screen may be used to separate the gravel from the clay and permit the fine particles containing the gold to pass through onto the gold tables and sluices below. For this service a constant-speed motor is recommended, which can be placed on the upper deck and belted down to the driving pulley of the screen.

Stacker.—After screening, the large rocks are carried on a belt conveyor to the end of the stacker and deposited on the spoil in the rear of the dredge. For operating this conveyor, a constant-speed motor is installed at the extreme end of the stacker, where it can be readily housed.

The power for operating these dredges is usually transmitted by the various electric companies to a sub-station near the base of operations, at three-phase, sixty cycles, the voltage varying from 2,000 to 6,000 volts. Current is carried to the dredge through an armored cable floated on pontoons, where it passes through the main line oil switch to the switchboard, and is distributed to the various motors.

New York Barge Canal and the Hydraulic Dredge.

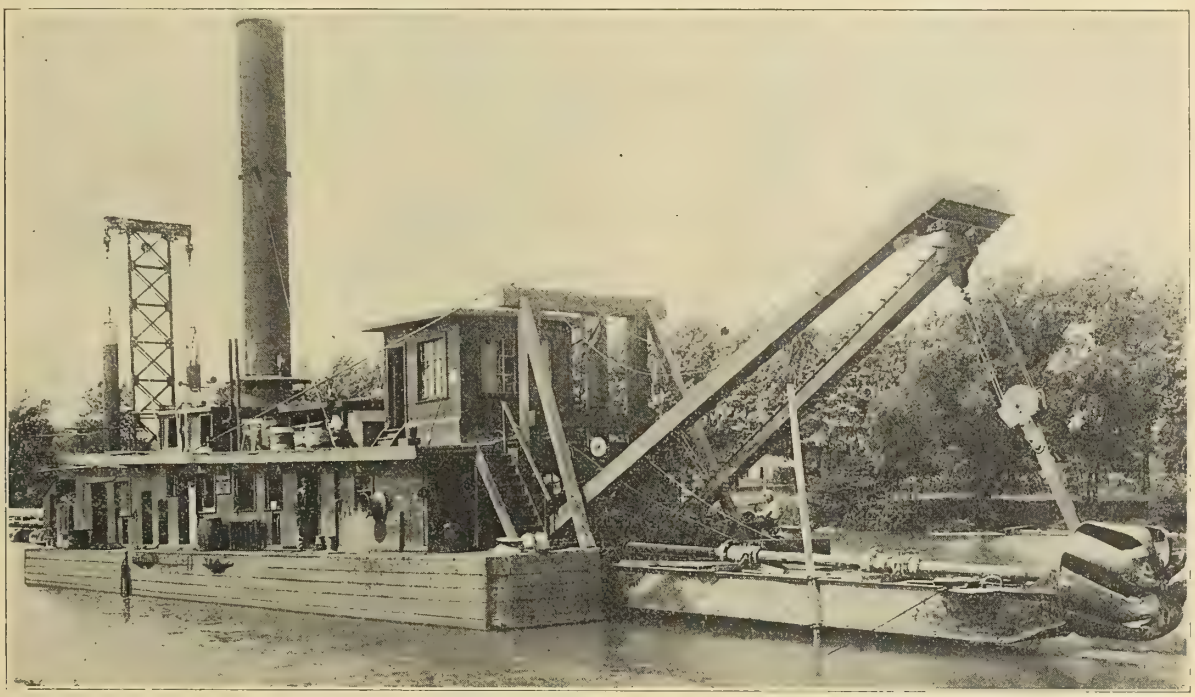
Until recently the use of the hydraulic dredge has been confined within rather narrow bounds. During the construction of the New York Barge Canal, however, a type of hydraulic dredge has been developed which has distinctly widened this field, and has made possible the utilization of this very desirable type of machine on work formerly belonging entirely to the dipper or elevator dredge. When the first of these dredges was built there were already a number of the older type in use on various parts of the canal. Some were successful, but others had proved expensive experiments, largely due to the attempt to dig material which cannot be successfully handled by the ordinary type of hydraulic dredge. The Bucyrus Company, of South Milwaukee, Wis., decided therefore to profit by this and build a more substantial machine. The result was three dredges carrying 20-inch suction and discharge pipes and equipped with heavier and more powerful machinery and greater boiler capacity than other dredges of the same type heretofore built. The material, it was found, that these boats could handle surpassed the most sanguine hopes of the engineers. One of the dredges was started in light material, consisting for the most part of gravel and clay. After working for some time in this material it struck unexpectedly a pocket of cemented gravel. In order to economize on time and also to experiment with this heavier type of machinery it was decided to try the dredge out on this material. This they proceeded to do, with no apparent ill effects except a small decrease in the output and a little more rapid wear of the cutter head. To overcome this a heavier cutter was substituted, made of a specially treated nickel chrome steel known as "YZ," developed by the Bucyrus Company in connection with placer dredges. This cutter is driven



BUCKETS ON THE GENERAL ELECTRIC DREDGE.

by a 10 by 14 independent engine. The pump casing and runner are particularly heavy, both being of "YZ" steel. The casing is unlined, with a shell of 2¼ inches maximum thickness in the zone of the greatest wear. To add to the available wear the shell is increased in thickness by radial ribs. The unlined pump casing has lately grown in great favor among dredgers for several reasons. In the first place, a lined pump has a high first cost and up-keep, and, secondly, experience has proved that it is exceedingly troublesome and expensive to keep in proper repair. The unlined casing, on the other hand, requires little attention, and when made of high-grade steel has a sufficiently long life to make it more desirable. Indeed, the saving in repair time alone more than makes up for the possible shorter life. The pump is driven by a vertical, triple-expansion, non-reversible engine of the marine type, with cylinders 15, 22 and 36 inches in diameter and an 18-inch stroke.

The boiler is 750 horsepower, designed for a steam pressure of 190 pounds. Practically every part except certain engine fittings is of steel, cast iron being eliminated wherever possible. A five-drum winch operates the spuds, the ladder and the swinging lines. This is driven by an independent 8½ by 8 engine. The discharge pipe in the stern is made with a special design of double swiveling joint, which takes care of the change in trim of the dredge and also allows for the wave motion. The pipe line consists of 32-foot sections of steel pipe riveted together. This pipe line may vary in length, of course, with the distance of the disposal areas. It is floated on pontoons consisting of heavy watertight casks. The sections are joined by means of strong rubber sleeves. The shore line consists of 16-foot sections joined by telescoping. The full capacity of these dredges under the most favorable conditions has never been tested. The *Clyde,* however, has done 1,230 cubic yards an hour in extra heavy material, and under more favorable conditions had made, with ease, 400,000 yards a month in two shifts of eight hours each. In five months last summer the dredge made 1,300,000 cubic yards, despite the fact that during one month a very heavy streak of slate was encountered amounting to some 75,000 cubic yards, which required a whole month to clean up. This output was made working three eight-hour shifts.

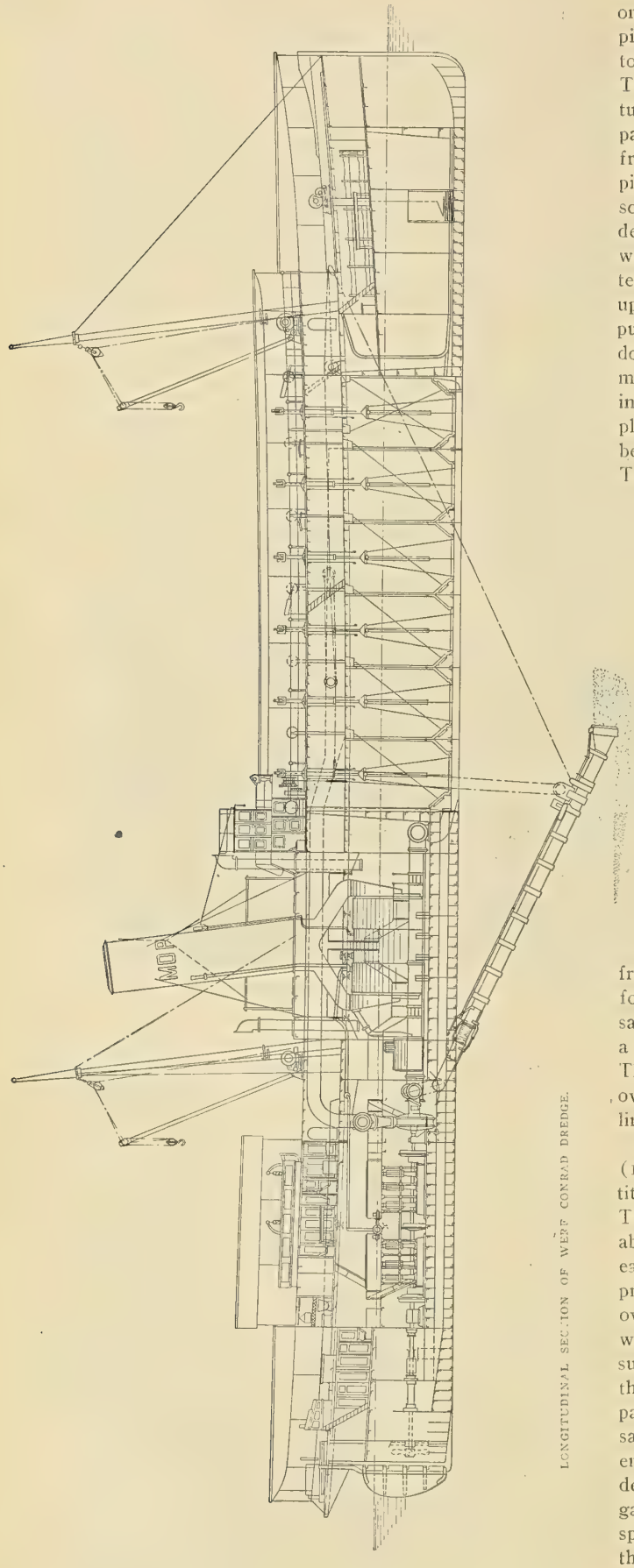


*BUCYRUS COMPANY'S HYDRAULIC DREDGE.

Suction Dredger for the Argentine Government.

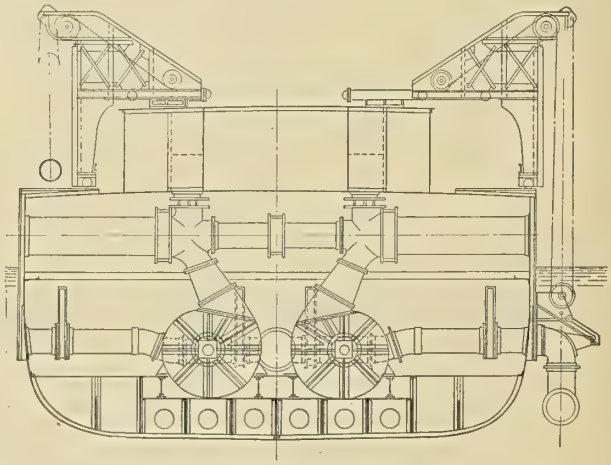
The Argentine government has received an addition to her fleet of dredgers, employed in the harbor works and the approaches thereto, in the new vessel *M. O. P. 209 C.* It is a powerful suction-hopper dredger, designed and built by the "Werf Conrad" Company, of Haarlem, Holland. The dredger has some interesting new features.

The dredger has a length of 84.5 meters, with a beam of 14 meters and a depth of 6.66 (270 feet by 44 feet 6 inches by 22 feet), and her loaded draft is 4.80 meters, or 16 feet. On this draft she carries besides 500 tons of bunker coal, 2,100 tons of dredged material, as found on the bar known as "Punta de Indio," for which exposed position the dredger is specially constructed and appointed. There are four sets of triple compound-surface condensing engines of 500 indicated horsepower each, two engines driving the screws and the two other engines driving each a centrifugal dredging pump. As the four engines are so grouped as to be two by two in one line, they may be readily connected so as to drive each pump or each screw with the aggregate power of both engines. When dredging, however, each engine runs separately, the connecting only being used either when pumping ashore over a long distance or when steaming on a long voyage. The vessel's speed when loaded is 10 knots when working at 1,700 horsepower. All four engines have one condenser in common, separate air and circulating pumps being provided, the air being left out at every transverse keelson between the doors, being a centrifugal pump made by the builders. The dredging pumps are built up from steel plates and angles, and have a complete internal lining of special steel, which is to be renewed when worn. They have suction pipes of 28 inches diameter, carried through the vessel's sides, one on the starboard, one on the port side and then pointing forward so as to be driven against the material to be dredged by the forward motion of the vessel. The lower end of each pipe, which is nearly on the half length of the ship when lowered down, is towed by a strong steel hawser, set tight by special steam winches placed above the cargo hold, which is covered over the greater part of its length, the water being only allowed



LONGITUDINAL SECTION OF WEST CONRAD DREDGE.

to escape from the hold over a short length at the extreme fore-end. The hawsers pass over sheaves fixed as near the bow as practicable at each side. There are two steam winches on the manœuvring deck for raising and lowering the suction pipes, and two hydraulic cranes take the after ends of the pipes to lift them above the deck level and to run them in-board. The catheads, from which the forward ends are suspended, turn up when the pipe is raised so far as to touch, so that this part of the pipes is also carried in-board. When pumping from the bottom the material is delivered into the hold by two pipes, which are of a square section, and without a bottom for so far as they run over the hold. Thus all material is first deposited at the extreme after-end of the hold, where, as the water can only escape at the extreme fore-end, and the material only comes farther forward when the after part is filled up, by which arrangement a great saving in the practical output is achieved. The hold may be emptied by the usual bottom doors or by the pumps, there being a special suction arrangement on the builder's own patent to achieve this. It consists in having the bottom doors of a hollow section formed by two plates, the lower plates being continuous, the upper plates being left out at every transverse keelson between the doors. These transverse keelsons also consist of two plates; in the



'THWARTSHIP SECTION OF DREDGE.

front plate a door is cut, which opens into the suction channel formed by the bottom doors. Water is admitted if necessary by valves on the front bulkhead of the hold, thus insuring a strong current to force the stuff into the suction channel. The delivery in the case of drawing from the hold is directed overboard or into a connection pipe to which the floating pipe line can be attached.

The official trials gave an average output of 6,000 meters (18,000 square feet) of dredged material per hour, this quantity filling the hold completely in only fifteen minutes' working. The emptying by the pumps takes still less time, or about twelve minutes on an average. The bottom doors are each separately worked by a vertical hydraulic press, these presses being operated from the bridge deck, which extends over the full length of the hold. There are also the hand wheels for working the smaller doors, giving access to the suction channels in the bottom, and the winches for working the suction pipes as well as the hydraulic cranes for the after part of these pipes, so that all the work is carried out on the same deck level. A flying bridge, with wheel-house and engine telegraphs, is supported on pillars above the working deck, and affords a free view all round necessary for the navigation of the ship. In the engine-room there are also fitted special high and low-pressure pumps for forcing water into the interior of the suction pipes to facilitate the clayish material in gliding without too great a resistance. The suc-

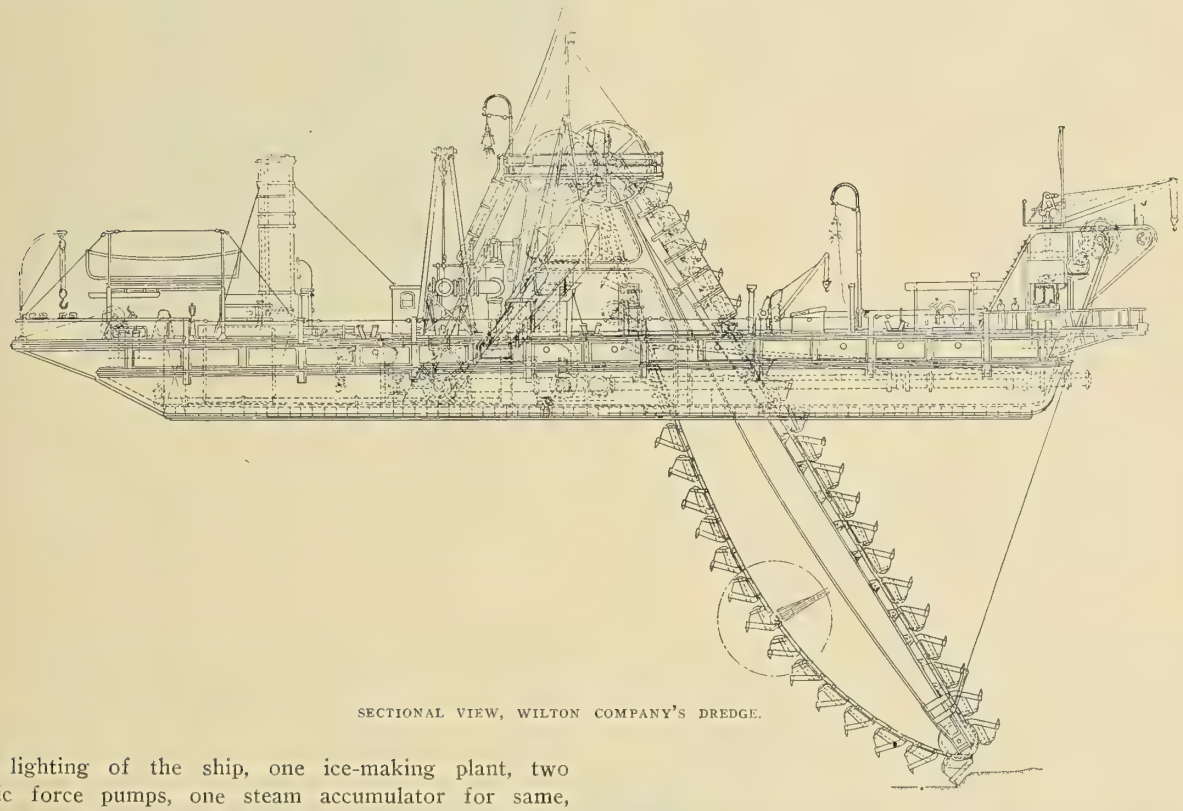
tion pipes are fitted outside with hollow rings, to which the delivery pipes of these pressure pumps are attached, small nozzle-shaped plugs being screwed into the thick plates of the suction pipes into such positions as to create a spiral film of water inside the pipes. This arrangement, invented by Mr. Carlesimo, has proved to be effective in dealing with the material found at Punta de Indio. The suspension of the after part of the suction pipes is arranged so as to give a little when the resistance against the pipes in the bottom becomes too great. Thus the bend at the ship's side is curved downwards, and a flexible connection of curved form used in lieu of the ordinary straight length of flexible joint. The arms carrying the weight of the pipe are hung from the bend, and these links allow of sufficient play to lift the mouth of the pipe free from the bottom, by means of a cable pulling the forward suspension in a broken line instead of the straight line corresponding to the usual position.

As auxiliary machinery there is a complete installation for electric lighting of the ship, one ice-making plant, two hydraulic force pumps, one steam accumulator for same, steam steering gear, windlass and winches near the masts for lifting weights of 15 tons and 10 tons, respectively, at fore and main mast. A complete repair shop is installed on a level with the upper platform in the engine-room, containing an electrically-driven lathe, shaping machine, punch and shear, drilling machine and smith's hearth. Electric fans are installed in the engine-room and crew spaces, as well as in cabins, and the sanitary arrangements of the vessel are very complete, there being four bath rooms with hot and cold showers and sitting baths completely fitted. The crew's quarters are in the bow under the main deck, the ship's officers aft under the same deck, while there are a suite of engineers' cabins on the main deck at each side of engine-room trunk casing, comprising cabins for chief engineer of the surveying department, seven assistant engineers' mess room, bath room and closet. The equipment is completed by a fast steam launch, set overboard by the after derrick; further, there are two life-boats and one dinghy. The life-boats are hung on stout arms of channel section, connected by a pipe running over the full length of the boat. To this pipe the boat's falls are attached and the whole arrangement is suspended from the funnel. When the boat is lifted from its chocks the arms are lowered down so far as to carry the boat clear from the suction pipes, after which the boat is lowered by its own gear.

A Combined Suction and Bucket Dredge.

The Wilton's Engineering & Slipway Company, of Rotterdam, Holland, has built for Mr. C. H. Campbell, dredging contractor, of New Broad street, London, England, a dredge which has been named *Subworker*. It is of the following dimensions:

Length	141 feet.
Length over horn ends	161 feet.
Breadth	27 feet 11 inches.
Depth at fore end	12 feet.
Depth aft	10 feet 4 inches.



SECTIONAL VIEW, WILTON COMPANY'S DREDGE.

The vessel is built under Lloyd's and fitted with a triple-expansion steam engine of 300 indicated horsepower. The transmission to the top tumbler is by means of heavy belts and cast steel spur wheels with double helical teeth. The sand-pump is coupled directly to the crankshaft, and has suction and discharge tubes of 21½ inches diameter. The maximum dredging depth by buckets or suction tube is 59 feet. The chutes are inclined to the stern in order to work with long barges. The center chute is automatically worked by the ladder to get the right position for the different dredging depths. The barge-loading arrangement of the pump is made by steel pipes, as shown on the print. The buckets contain 24 cubic feet, and are constructed of special steel, the weight of each bucket being 24 cwt., and each bucket being fitted with three manganese steel digger teeth. The picture herewith shows the trials at Rotterdam, in which the dredger lifted 400 tons of material per hour.

This dredger is fitted out with a main and an auxiliary ladder, permitting her to dredge at great depths with total guidance of the buckets and under a good angle of excavation.

U. S. Suction Dredge New Orleans.

In presenting particulars of the *New Orleans,* now under construction by the Fore River Shipbuilding Company of Quincy, Mass., it is of interest to review briefly the comparative conditions under which dredges are operated in America and in other countries.

In the United States and Europe the development of dredging appliances has progressed along somewhat divergent lines. In the former the tendency has been to employ the outside contractor in the development of harbors and channels, while in Europe it is common to find such work in control of local authorities created for the particular purpose. The private contractor naturally wishes to restrict the size and expense involved in his plant, while a powerful public corporation will build the largest possible appliances, regardless of first cost, with a view to the greatest economy in operation—therefore, we may expect to find in the United States a great development of the smaller type of dredge, such as the dipper, clamshell, and small suction-pipe line types, while in Europe we find the greatest advance in the building of the enormous bucket-ladder, hopper, suction and other costly but powerful and economical dredging appliances. But in the United States there is one exception. The War Department, which, through the Corps of Engineers, controls all river and harbor developments, is the largest owner and operator of dredging plant in the world, and is necessarily involved in dredging projects of the greatest size and importance, from that of the Panama Canal downwards. One of the problems of great complexity is the keeping of the entrances of the Mississippi River clear of the mud which comes down in endless volume. Jetties have been built at great expense with a view to creating a scouring action in the channel, but an enormous accretion of mud in shoals results at the end of the jetties and forms a bar obstructing the passage of large vessels. To cut this bar and continue the course of the channel between the jetties, continual dredging is essential. The conditions compel the use of the largest and most powerful type of hopper dredge available and it became necessary, therefore, for the Corps of Engineers to adopt some novel type of dredge in order to handle the enormous masses of mud economically and efficiently. Hence the order for the *New Orleans.*

This dredge is of the following dimensions:

Length over all (not including dredge head)	315 feet
Length between perpendiculars	300 feet
Breadth moulded	50 feet
Depth moulded	26 feet
Length of hopper	93 feet 9 inches
Capacity of hopper	3,000 cubic yards
Draft loaded	20 feet
Coal bunker capacity	300 tons
Speed loaded	10 knots

The vessel has a straight stem and twin semi-elliptical sterns, between which the dredge arm is placed, and is rigged with the two pole masts. The ten hopper wells are located amidships with the boiler-room immediately forward and the engine-room abaft of them. From the after engine-room bulkhead aft, the vessel has a channel or well, dividing the hull and forming twin sterns. In this well is arranged the dredge suction arm, forming a huge girder about 67 feet long, incorporating the two 9-inch diameter pressure water and two 26-inch diameter suction pipes. At the forward end of this well a massive cast steel pillar block on each side supports a pair of heavy cast steel trunnions, which in turn carry the girder arm. At the lower end of the girder is a huge pair of hinges by which the bucket head is attached so that it has a movement of rotation about a horizontal axis at right angles to the direction of the girder to enable the cutting angle to be varied at will. This dredge head is manipulated by durable steel wire rope falls running over

THE DREDGE NEW ORLEANS.

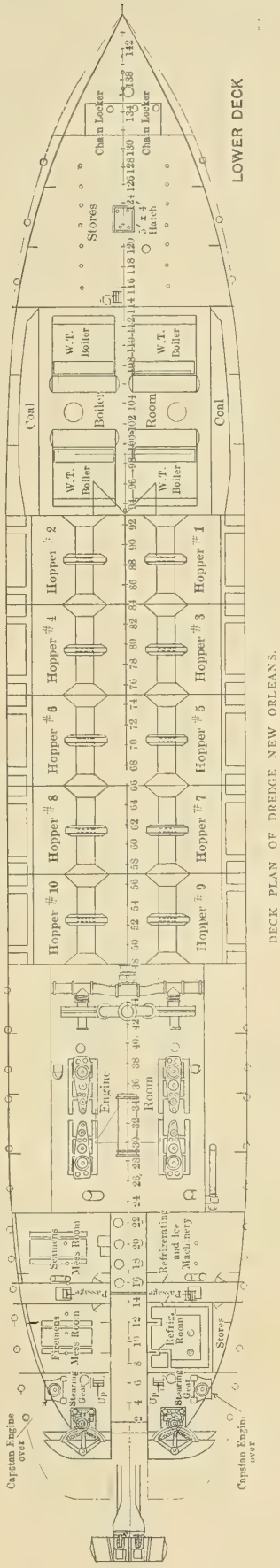
ANOTHER VIEW OF THE WILTON COMPANY'S DREDGE.

large sheaves carried on a massive stern bridge built astride the well, the falls in turn being operated by a powerful deck winch, which enables the dredge head to be lowered to a dredging depth of 50 feet or to intermediate depths, or raised clear of the water. The head, as already explained, is practically a huge enclosed rake, which in the case of the *New Orleans* is some 18 feet wide by 5 feet fore and aft, serrated along the edge with sharp cutting teeth through the incisors of which is ejected high pressure water to aid in disintegrating the spoil and make it of suitable consistency to be sucked through duplicate suction pipes into the pumps from which it is deposited in either of the several hoppers.

Installed in the engine room are two specially designed 26-inch centrifugal dredging pumps, having chambers lined with manganese steel and with removable wearing pieces on the impellers of high grade cast steel. The main engines comprise four sets, arranged in pairs tandem and built on common bedplates, of triple expansion inverted marine type, having cylinders 12 inches, 19 inches and 32 inches, with a common stroke of 24 inches and capable of exerting a combined horsepower of 2,500. The two after sets of these main engines are coupled direct to the propeller shafting and the two forward sets to the 26-inch centrifugal dredge pumps. By an ingenious arrangement of clutches the propelling and pumping engines can be coupled together so that the full power of all four engines can be exerted on the twin propellers when desired, while, when dredging, the after sets will be free to drive the propellers and the forward sets will drive the dredging pumps. The pressure water or jet pumps for disintegrating the material being dredged are three in number, of the vertical duplex pattern, capable of a combined capacity of 300 cubic feet of water per minute. Steam is supplied by four Babcock & Wilcox watertube boilers, having a total heating surface of 12,664 square feet and grate surface of 317 square feet. The installation is capable of filling the ten hopper holds in less than 120 minutes, the combined capacity of which is 3,027 cubic yards, or approximately 3,000 tons. The dredged material may then be transported by the vessel to any convenient dumping ground at a speed of 10 knots per hour, when, by the manipulation of four hydraulic ram mechanisms, the hopper doors, 20 in number and opening outwardly through the ship's bottom, may be operated either individually or simultaneously for discharging material, an operation, therefore, occupying only a few minutes when all doors are open.

The hoppers have a mixing water pipe system by which sea connections can be opened to furnish mixing pressure water to thoroughly loosen the precipitated material. Another important feature is the arrangement of settling troughs, baffle plates and overflow sluices provided to allow any surplus water which has been sucked in to escape overboard without carrying dredged material. Should it be desired to utilize the dredged material for reclamation work, a swivel deck discharging pipe has been installed, to which the necessary lengths of shore piping may be coupled, and through this pipe the dredge can discharge her own cargo by sucking it from the hoppers and ejecting it to any location desired or, as a third alternative, into scows or other hoppers alongside.

The *New Orleans* furnishes comfortable and commodious quarters for its crew. The captain, inspector and first mate are berthed in a large deck house, while the chief engineer and his assistants have been accommodated in the after deck house and adjoining the engine room. This after deck house is also arranged for stewards, cooks, etc., and provided with suitably furnished mess rooms for officers and petty officers, together with toilets, wash places, etc. On the lower deck aft on each side of the well are mess rooms for seamen and firemen, cold storage rooms and refrigerating machinery.



DECK PLAN OF DREDGE NEW ORLEANS.

The monkey forecastle is divided off into quarters for seamen, firemen, oilers, storerooms, wash places, carpenters' workshop, etc., while nearby are located the quartermaster and boatswain. As the *New Orleans* will operate mostly in semi-tropical waters, the greatest attention has been paid to the sanitary and ventilation arrangements, and all living quarters and machinery places are well supplied with both artificial and mechanical ventilation.

The auxiliary machinery comprises a No. 9 Hyde Windlass Company's steam and hand windlass, three No. 3 Hyde Windlass Company's steam capstans, and twin sets of Williamson Bros.' spring quadrant type steam steering gear, operating the two rudders in unison and controlled by an improved telemotor system operating from pilot house forward. Considerable attention has been paid to the special hoisting winch, furnished by the Lidgerwood Manufacturing Company, which has been designed so that when there is a pull of ten tons on each dredge arm fall, the winding speed will not be less than 50 feet per minute. This winch is placed on top of the after house, on a steel foundation built up from the main deck, and arranged so that the winch man will have a clear look-out aft and operate the engine, to lift or lower the dredge arm, by turning a vertical wheel either to port or starboard as in a steering-wheel. The electric light plant consists of two 110-volt generators, each of 25 kilowatt capacity, driven by Curtis steam turbines. The vessel is lighted throughout by electricity and in addtion there is supplied a searchlight, of 35 amperes capacity. A steam heating system is installed, with individually operated radiators.

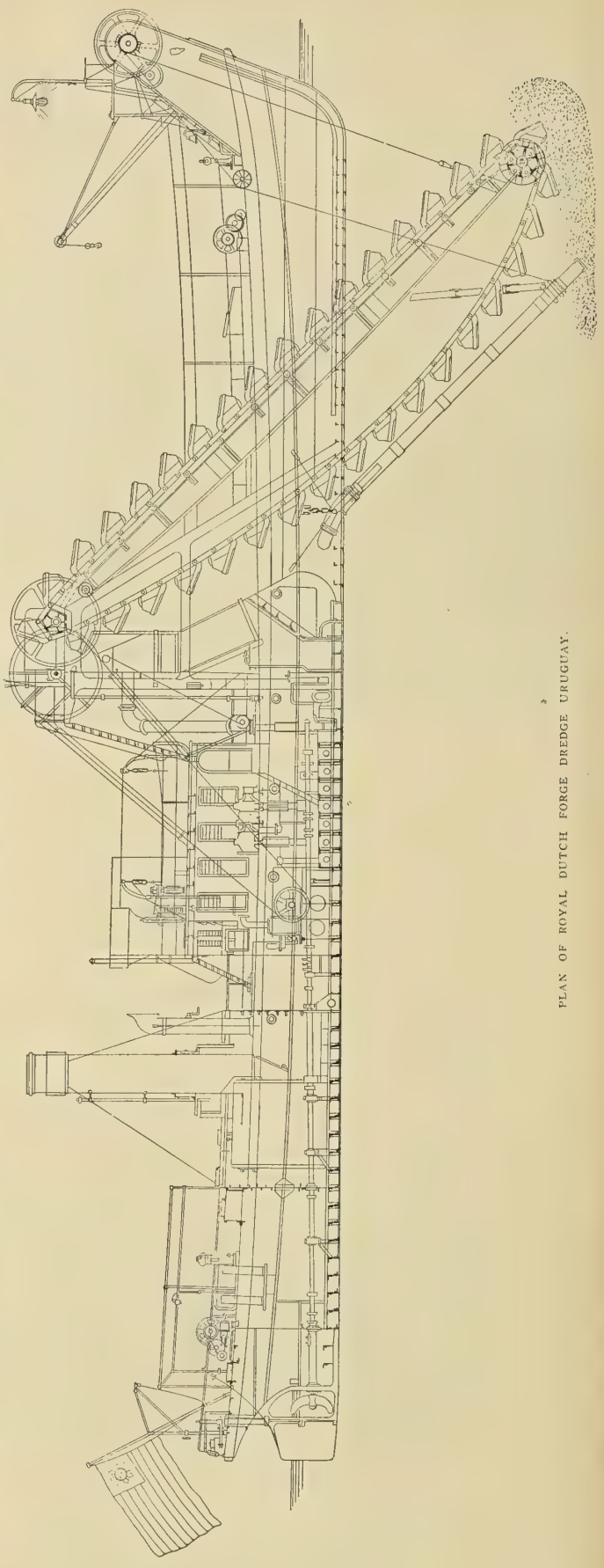
Self-Propelling Bucket-Suction Dredger Uruguay.

Dredger *Uruguay* was ordered by the Uruguayan government from the Koninklijke Nederlandsche Grofsmederij (Royal Dutch Forge Company), at Leiden, Holland, and represents a type of dredger which can be called an universal dredger. The material to be dredged can be raised either by a bucket chain or a suction pump, and delivered in barges alongside or through a floating pipe line direct on shore at a distance of 1,000 feet against a height of 20 feet. The principal dimensions of the dredger are as follows:

	Feet.
Length over all	145
Breadth	26
Depth molded	9
Draft, maximum	5
Dredging depth	27

The draft was kept as light as possible to enable the dredger to pass over the various sandbanks in the river mouth, where she is intended to work. The vessel is provided with two compound surface-condensing engines; one engine, placed lengthwise, for driving the suction pump and the propeller, the second engine, placed athwartships, for working the bucket chain. The vessel is further provided with four double-cylinder steam winches for working the hoisting ropes for the bucket ladder and suction pipe, the bow, side and aft chains. The dredger is lighted by electricity throughout. Steam for the above-mentioned engines is supplied by two marine boilers, having each a heating surface of 753 square feet and a working pressure of 120 pounds per square inch.

The bucket chain has a capacity of raising 300 tons of material per hour. The buckets are constructed of steel plates and provided with hard steel cutting bands. The engine power is transmitted to the upper tumbler shaft by two belts, two pulleys and two sets of cast steel gearings. The sand pump is of equal capacity to the bucket chain, and is constructed of steel plates and angles, and fitted inside with removable hard steel weaving plates. The flyer is of S. M. steel,



PLAN OF ROYAL DUTCH FORGE DREDGE URUGUAY.

forged in one piece—the flyer shaft fitted with hard steel weaving bushes. The suction pipe is constructed of ⅜-inch steel plate, and is mounted on a strong ladder placed in well. The delivery pipes are mounted on floaters of cylindrical form, and constructed of steel plates and coupled by means of specially designed couplings of armored leather. The dredger has been tested thoroughly, and the output of the bucket-chain as well as of the suction pump showed an excess of the requirements stipulated by the government. The vessel made her voyage to Montevideo under her own steam.

The hull is steel fitted with four watertight bulkheads. The boilers are two in number, of the return tubular type, 8 feet 9 inches diameter by 13 feet 9 inches long, each, and are fitted with superheaters. Sixty pounds of steam is carried. Her engine is a vertical condensing beam with a 40-inch cylinder and a 9-foot stroke. Feathering paddle wheels are provided, 20 feet in diameter, with 8-foot buckets, which are of oak. She is fitted with a Hyde windlass, capstan and steam steering engine. The electric plant is a 20-kilowatt General Electric outfit direct connected. Sixty tons of coal

SUCTION DREDGE URUGUAY IN OPERATION.

Chesapeake Bay Steamer Three Rivers.

The Maryland Steel Company, of Sparrows Point, Md., has completed, for the Maryland, Delaware & Virginia Railroad, the side wheel steamer *Three Rivers,* for night service on the Chesapeake Bay, to accommodate 350 passengers. The dimensions of this vessel are:

Length on water line	180 feet
Length over all	188 feet
Beam, molded	36 feet
Beam, over guards	57 feet 6 inches
Depth, molded	10 feet 5 inches

can be carried in the bunkers. The finish of the boat is very acceptable, the joiner work being painted white with gilt relief. The main stairs, however, are hard wood. Interlocking ribber tiles are fitted throughout, except in the kitchen and pantry, where asbestolith is used. In all the rooms steam heat is supplied, as is also running water. Every comfort has been provided for passengers.

NEW BAY LINER THREE RIVERS.

The British navy estimates, as made in a preliminary announcement, call for an expenditure of £44,392,500 ($221,962,500) for 1911. The programme includes five *Dreadnoughts,* three protected cruisers, one unarmored cruiser, twenty destroyers, six submarines and an increase in the personnel.

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TYPE 1. For general run of castings, such as propellers, propeller struts, couplings, relief valves, shaft sleeves, thrust rings, gear pumps, hooks, gun mountings, stern bearings, etc., etc.

TYPE 2. For marine fittings, condensers, gate valves, rocker arms, bilge pumps, binnacle stands, mast fittings, cleats, chocks, belaying pins, governors, search light stands, towing hooks, brackets, eccentrics, throttle valves, torpedo tubes, torpedo breeches, conning towers, periscopes, deck plates, etc., etc.

TYPE 3. For engine housings, engine bedplates, air compressor bedplates, air compressor framings, hand wheels, gears, rudder bearings, stuffing boxes, windlass gears, windlass drums, bearing brasses, bushings, spiral gears, port lights, air pumps, reducing valves, etc., etc.

TYPE 4. For whistles, radiator valves, also for forging purposes.

TYPE 5. For plug cocks, steam traps, thermostats, etc.

TYPE 6. For forged pump rods, bolts, valve stems, hose couplings and all kinds of fittings to be riveted. This type is also produced for rolling and drawing.

TYPE 7. For general hardware, quadrants, railings, name plates, indicators, hatches, grease cups, oil cups, gauges, stanchions, engine telegraphs, controller fittings, etc.

TYPE 8. For air compressor cylinders, oil pumps, injectors, exhaust headers, exhaust valve bodies, elbows, tees, water jacketed bearings, gas mufflers, hydraulic valves, hydraulic valve fittings, steam valves, etc. It is a high pressure Steam Metal.

TYPE 9. A special metal used in ship bells, electric bells, electric gongs, fire bells and gongs, submarine signal bells, etc.

TYPE 10. For turbine buckets, superheated steam valves, steam nozzles, pump linings, trolley wheels, circulating pumps, safety valves, journals, glands, etc.

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1	71,000	28,500	32.0	27.8	1 Inch
2	65,400	28,400	38.5	31.1	1 Inch
3	65,100	34,400	18.5	17.2	1 Inch
4	56,900	22,800	57.5	43.7	1 Inch
5	59,500	22,000	52.0	37.6	1 Inch
6	51,100	18,100	65.0	45.3	1 Inch
7	59,200	23,000	50.0	39.1	1 Inch
8	32,000	17,500	21.0	18.8	1 Inch
9	62,940	32,960	8.0	17.0	1 Inch
10	70,000	40,000	21.8	....	1 Inch

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FRENCH AUXILIARY MOTOR SHIPS.

BY J. PELTIER.

The total amount authorized in France as bonuses to the shipbuilders and ship owners, according to the law of 1893, amounted to 151,000,000 francs (£6,040,000) ($30,200,000). The big "wind-jammers" built under this law profited most by it.

In 1912 sailing ships will receive their last subsidy. Many ship owners, not being able to carry on their business without a subsidy, are now trying to obtain a "special compensating law," while well-managed and old firms are attempting to hold their business through up-to-date methods of appliances. Messrs. Prentout-Leblond and T. Leroux, of Rouen, who are known all over the world for their enterprising spirit, among other shipowners decided last year to alter their four-masted petroleum bark into an auxiliary ship. In order to do this, the *Quevilly* underwent alterations for nearly one year in the Havre docks, changing her stern and putting in twin screws, expending about £6,000 ($30,000), which included installing oil motors. This four-masted bark was built in 1897 by Messrs. Laporte & Company of Grand Quevilly, near Rouen, and she proved herself in every way a seaworthy boat, making several remarkable passages between New York and Havre. She is steel-built, divided into ten watertight compartments, with two steel decks extending fore and aft, giving her great longitudinal strength. She is propelled by twin screws actuated by four-cylinder Diesel engines, built by the Maschinen Fabrik Augsburg-Nurnberg Akt.-Gesellschaft. Her trial trip was carried out on the 15th and 16th of January, last. Her displacement is about 3,000 tons and the best run she made on the measured mile was somewhat over 7 knots, her average speed being 6.1 knots. It is expected, however, that with 100 tons of fuel in her tank her radius of action will be 4,000 to 4,500 nautical miles. The owners of the *Quevilly* were so confident of results that before any trial was made they ordered a five-masted auxiliary cargo boat from the Gironde Works & Shipbuilding Company, Bordeaux. She is named *France* and will be the largest of her class, and will be put in the New Caledonian ore trade. Her dimensions are as follows:

Length over all, 131 meters (430 feet).

Length between perpindiculars, 119 meters (390 feet).

Mean breadth outside plate, 17.50 meters (57 feet 5 inches).

Mean draft astern, fully loaded, 7.20 meters (23 feet 6 inches).

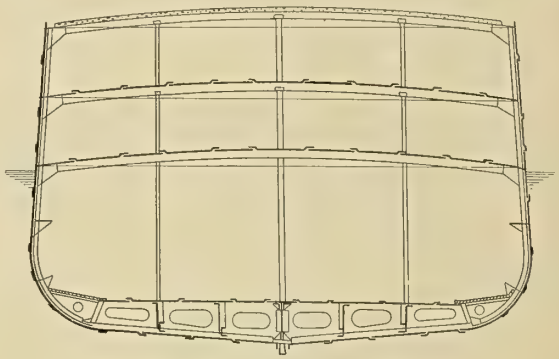
Cubic capacity, 9,960 cubic meters (352,000 cubic feet).

Displacement, fully loaded, 10,730 tons.

Gross tonnage, 6,100 tons.

Net tonnage, 5,500 tons.

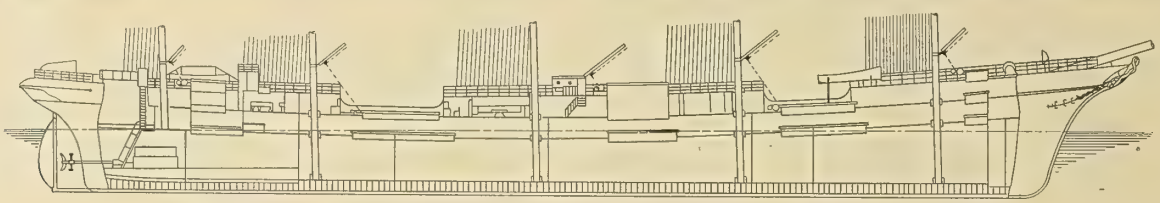
This vessel will be propelled by twin screws, the motive power being two Diesel engines, two cycle, of the Schneider-Crels improved patent of 900 horsepower each. The main engines, auxiliaries and fuel tanks are located aft in a watertight compartment. As the stern of the ship, on account of the contracting lines, is of little use for cargo, the engine room will be situated aft, thus making more room for cargo. The motors are to be built by Messrs. Schneider & Company at their works at Le Creusot. Windlass, winches and capstans, respectively five and nine in number, will be used for handling the anchors, hawsers and cargo, and will be actuated by steam, a donkey boiler being fitted on board for generating steam. It is to be noted that all mainsails and the general working of the ship and its sail are to be handled by the use of the steam winches. She will be lighted throughout by electrcity, the generator being run by a small motor. She will also be heated throughout by steam. The accompanying



THWARTSHIP SECTION OF FRANCE.

drawings give details as to the engines, arrangements and accommodations, etc.

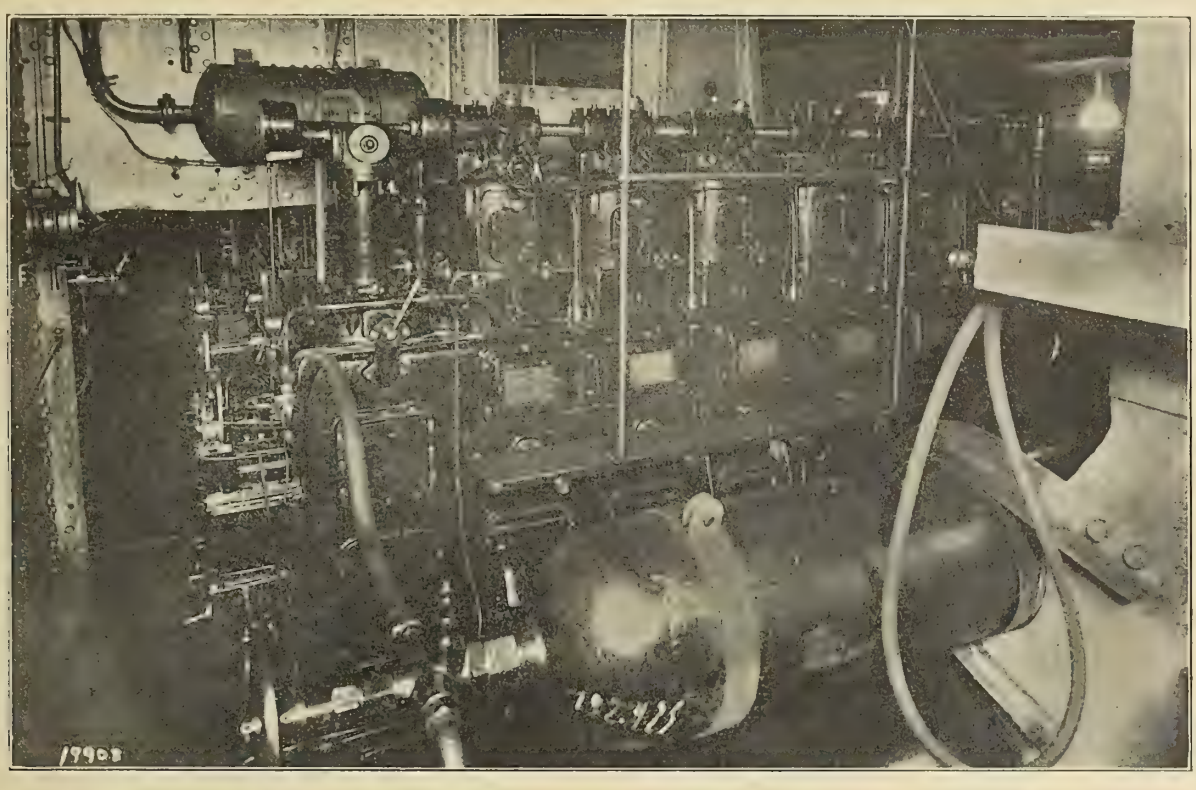
If the hoped-for results are obtained, the *Quevilly* and the *France* will become new types of long-distance, or over-sea vessels, and such ships ought to be the best and cheapest for such work. On shorter voyages it may be found that motor boats will prove more efficient than auxiliary-fitted vessels, but on long voyages the auxiliary ship will undoubtedly prove more satisfactory. In 1902, owing to the large number of big sailing ships built in France, close attention and study were given to the type which promised best returns, and the auxiliary ships will undoubtedly prove themselves the more efficient, being able to make regular trips, independent of calms or contrary winds. The many sailing ships built under the subsidy law of 1893 cost on an average 650,000 francs (£26,000) ($130,000) and it is figured that the cost of an auxiliary motor would amount to £2,000 ($10,000) extra, and the ship owner could well afford to pay this additional sum, as it practically doubled his income.



LONGITUDINAL SECTION OF MOTOR-EQUIPPED SHIP.

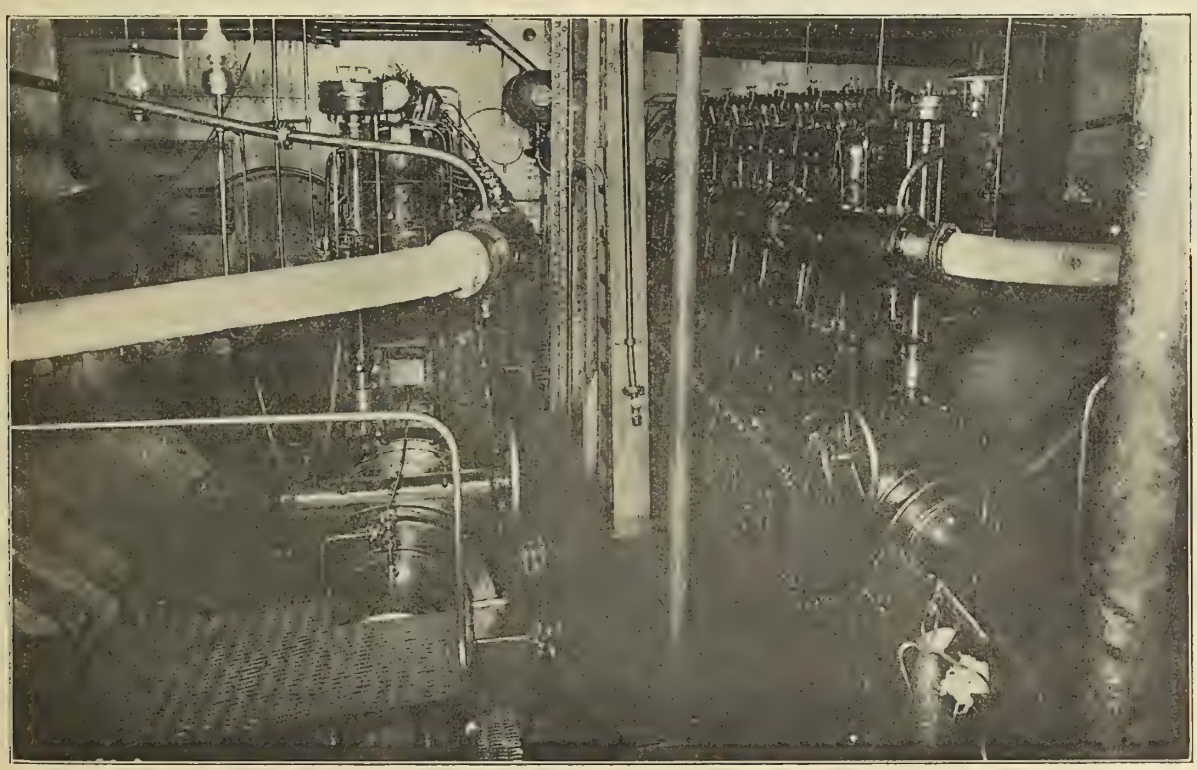
In an article published in the French press about twelve years ago it was said that a 50 horsepower motor, or two 75 horsepower motors, weighed 70 tons approximately, and that these operated by liquid fuel would give satisfactory results, such fuel being easily obtained all over the world, and at a price even lower than in France. The revolutions considered best for the propeller were about 200 per minute, and they should be so located as to be completely submerged when the ship was in ballast, and it was suggested that the handling of the motors should be so arranged that it could be done from the deck. On a consumption of ⅛ gallon per indicated horsepower hour, this ship would have a radius of action of about 1,000 miles, or 265 steaming hours. She would be able to navigate anywhere, and certainly such an equipped

boat would have every advantage possible in getting charters, as she would have to pay less insurance, no towing bills, less local pilotage, canal, lighthouse or harbor dues.



SIDE VIEW OF ENGINE ON THE QUEVILLY.

We find in the Lloyds and the French Veritas only twenty-three auxiliary ships of 300 tons net register, and of vessels of

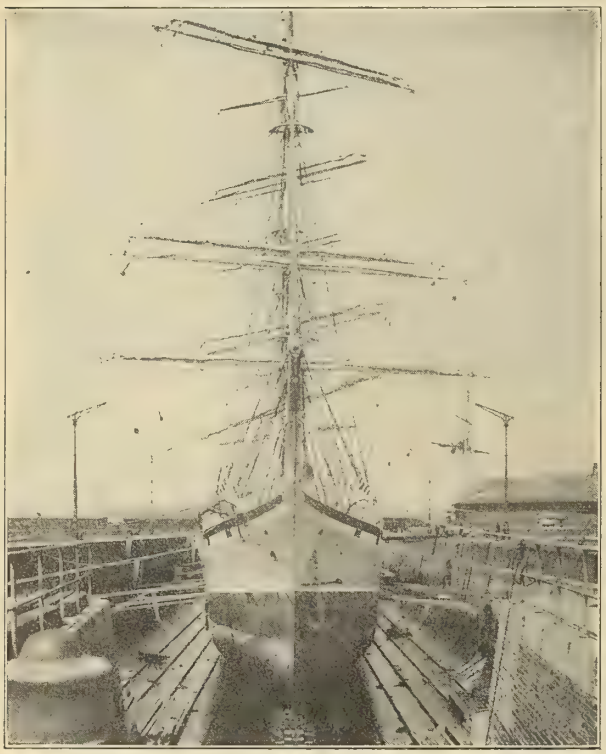


OIL MOTORS ON THE AUXILIARY SHIP QUEVILLY.

1,000 tons register there are only four. The following information should be looked at with attention, noting especially the *Herzogin Sophie, Charlotte* and *R. C. Rickmers,* the first-named being the training ship of the North German Lloyd. The *Rickmers* is a splendid vessel belonging to the well-known firm of Rickmers, Reismuhlen, Rhederei & Schiffau Akt. Gesellschaft, and was built in their Bremerhaven yard. As the owners' rice mills turn out something like 200,000 tons of rice a year, it was profitable, of course, to

transport this product in their own vessels. The *Rickmers* made long voyages under steam and canvas, her average mean speed being equal to that of any cargo boat of similar size, and, being fitted with engines, she was able to handle herself in all weather to advantage, and her running expenses were small. One of her first voyages from New York to Saigon lasted eighty-five days, and another from Hamburg to San Pedro ninety-seven days, and, in spite of the fact that she encountered very unfavorable weather in rounding Cape Horn, she made most satisfactory time, as the following log will show:

10,357 miles under sail in 60d. 13h. = 172 miles per day.
= 7.18 knots per hour.
5,504 " " steam in 37d. 4h. = 148.6 miles per day.
= 6.20 knots per hour.
15,861 miles in 97 days 17 hours = 156.61 miles per day or 6.8 knots per hour. The calm zones of the equator she passed through under her own steam and rounded Cape Horn partly under canvas and partly under steam.



THE QUEVILLY IN DRY DOCK.

STERN OF MOTOR-EQUIPPED SHIP.

During the season about sixty large "wind jammers" sailed from Europe to the Pacific ports, averaging 155 days for the passage, while the *Rickmers* gained 58 days over the sailing vessels. If we compare the voyage from Hamburg to San Pedro with the best trip made by the five-masted bark *Preusen,* the finest sailing ship under the German flag, from Cuxhaven to Valparaiso, some 5,000 miles shorter and which was covered in eighty-four days, it is fair to conclude that the *Rickmers'* passage, owing to her auxiliary engines, was most satisfactory, as she made an average of 141 miles per day, or 6 knots per hour, and carried 32,000 tons of cargo. It is somewhat surprising that the *Rickmers'* company, after obtaining such excellent results, did not build an improved ship, and that they did not must be accounted for by the extremely low freight rates during the last few years, and also to the extraordinary tonnage under way in English yards, and the general depression in trade. The triple expansion engines fitted to the *Rickmers* will not be duplicated, as the auxiliary motor evidently will answer the purpose far more economically. If we take into account the weight and space required for coal per mile or knot run, we can easily see that the net cost is greater than with liquid fuel, and a motor does not require from twelve to twenty-four hours to get up steam, and has many other advantages. This class of auxiliary boat will be a vast assistance between countries and their colonies for secondary lines of commerce, enabling them to have more frequent communication and at less cost. With the present prices quoted by shipbuilding yards, an auxiliary ship can be built cheaply; the motor can be installed economically, and these points must be alluring to enterprising ship owners. The firm of Messrs. Prentout-Leblond & E. Leroux of Rouen are to be complimented for their enterprise in equipping the *Quevilly* and the *France,* and these vessels will certainly be watched with the keenest interest by the shipping houses everywhere.

I may say that a company has been formed at Paris under the name of the "Société des Navires Mixtes," with a capital of 750,000 francs ($150,000) (£30,000) to develop this interesting type of auxiliary vessel.

The *Herzogin Sophie Charlotte* was built by the Rickmers Company in 1895. Her dimensions are as follows: Length, 276 feet 3 inches; breadth, 43 feet 2 inches; depth, 25 feet 5 inches. Her gross tonnage is 2,581, and net tonnage, 2,310. She carries water ballast to the amount of 1,150 tons, and is built of steel, with two decks.

The *R. C. Rickmers* was built by the Rickmers firm in 1906. Her dimensions are: Length, 410 feet 5 inches; breadth, 53 feet 6 inches; depth, 30 feet 4 inches. The gross tonnage is 5,548, and net tonnage, 4,696, and she carries water ballast of 2,700 tons. She is built of steel. Her engines (steam) are three-cylinder, 18⅞ by 30 11/16 by 47¼ inches, with a stroke of 31½ inches. This engine is to develop 1,000 horsepower and the bunker capacity is 630 tons.

The *Taisu Maru* was built by the Kawasaki Dock Yards in 1904 and was the training ship for the Japanese Navy. Her length is, 274 feet 4 inches; breadth, 42 feet 9 inches; depth, 24 feet 1 inch. She is built of steel, with four decks, and fitted with two triple-expansion steam engines, 13 by 21 by 34 inches by 27 inches stroke. She has, of course, two propellers.

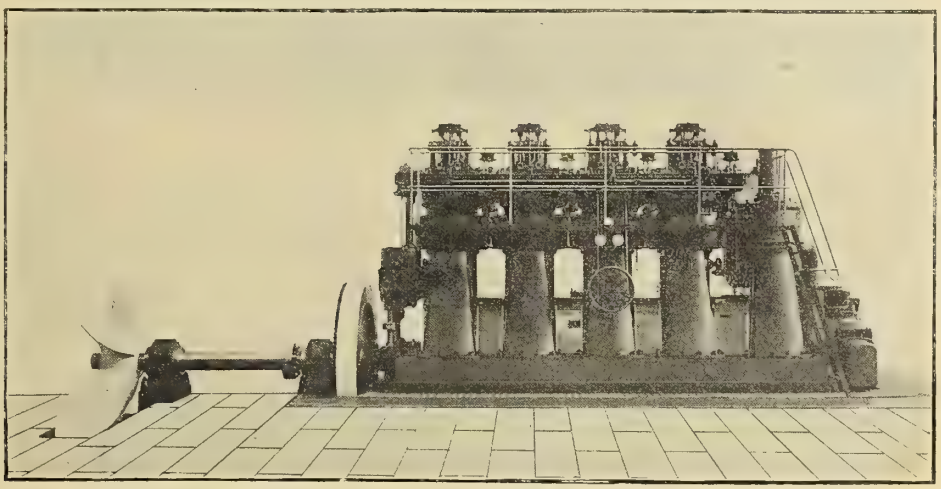
The *Quevilly*: This vessel was built by Leporte & Company in 1897. Her length is 308 feet 5 inches; breadth, 45 feet 8 inches; depth, 26 feet 8 inches. The gross tonnage is 3,271; net tonnage, 2,578. She is built of steel, with two decks and ten watertight compartments. Two motors are Diesel, of four cylinders each, and develop 300 horsepower each.

A 1,000 Horsepower Marine Oil Engine.

BY J. RENDELL WILSON.

There is far more activity on the Continent than is generally realized in connection with the construction of marine oil engines of the Diesel type for large ships, and already engines of 1,500 horsepower have passed the test bed stage. Prominent among the firms making strenuous efforts in this direction are Carel Frères, of Ghent; Schneider et Cie., of Paris, and the Maschinenfabrik Augsburg, Nurnburg, the latter company having, by the way, a three-cylinder engine of 6,000 horsepower nearly completed; while Fried Knapp is said to have a marine oil engine building of well over 2,000 horsepower per cylinder. In view of these facts the illustration and following brief description of a four-cylinder engine of 1,000 horsepower, recently built by Messrs. Schneider & Company, in conjunction with Carel's, for a French cargo vessel that will trade on the Seine, should be of great interest. The illustration is from the Belgian paper *Neptune*.

The engine stands about 12 feet high, and is of the two-stroke reversible type, starting and reversing, etc., being, of course, by compressed air. The compressor, of the three-stage variety, is situated at the forward end, in appearance greatly resembling a fifth cylinder, and is driven off the crankshaft. This cylinder is shown next the fly-wheel. As in the case of other Diesel type engines, ignition is entirely by compression; that is to say, the fuel is sprayed in by air at a pressure of nearly 1,000 pounds per square inch, causing instant combustion. As the piston on the down stroke uncovers the exhaust port in the usual manner, it also uncovers a separate inlet port, which admits air from a special compressor at about 6 pounds per square inch. This air is also controlled by a valve in the cylinder head, which opens at the end of each stroke, allowing the cylinder to be well cleansed of all residual exhaust gases. When the piston covers the exhaust port at the commencement of the up stroke, this valve is closed. Pure air is then admitted and compressed to about 600 pounds per square inch, and the fuel is injected by the greater pressure at the top of the stroke. The same cycle of operations, of course, is then repeated continuously. It is of interest to note that it has been found necessary to water-cool the compressors as well as the cylinders and exhaust arrangements. To each cylinder there is a separate fuel pump, which can be dismounted and cleaned without stopping the engine, only the cylinder affected being put out of action. By having a separate fuel arrangement to each cylinder the fuel supply can be regulated independently if necessary. At any time the horsepower being given by any cylinder can be ascertained by the indicator diagrams with which each cylinder is equipped. Regarding lubrication, the crank case is of the enclosed type, and so forms a reservoir for the oil. It is supplied to the bearings by force from a pump, and en route it is filtered. The filter is equipped with a by-pass system, in order that it can be opened up and cleaned while the engine is running. While on test the engine gave every satisfaction.



FOUR-CYLINDER, 1,000 HORSEPOWER OIL ENGINE.

S. S. Honolulan's Voyage Around the Horn.

Steaming 14,000 miles on her maiden passage without being compelled to stop for repairs or overhauling is the enviable record made by the new American-Hawaiian liner *Honolulan*, Captain T. P. Colcord, which recently arrived in Seattle direct from Baltimore. During the run of 54 days, the only stop made was at Punta Arenas, where the vessel dropped anchor for ten hours to cable and also to await a favorable tide to run through the Strait of Magellan. The *Honolulan* was built by the Maryland Steel Company, Sparrow Point, Md., and the vessel's deck engineer officers speak in the highest terms of the steamer's performance.

When leaving Baltimore, the *Honolulan* carried 14,000 barrels of fuel oil, more than sufficient to steam over the long route. She arived on Puget Sound with 2,000 barrels remaining, establishing a name for herself as an economical vessel. The steamer *Missourian*, of the same fleet, two years ago sailed from the Atlantic to Puget Sound with enough fuel oil to last her the long distance, but, aside from these two instances, there is no record of other vessels having done the same to Puget Sound. The fast steamers *Yale* and *Harvard*, which recently arrived on the Coast, from New York, burned

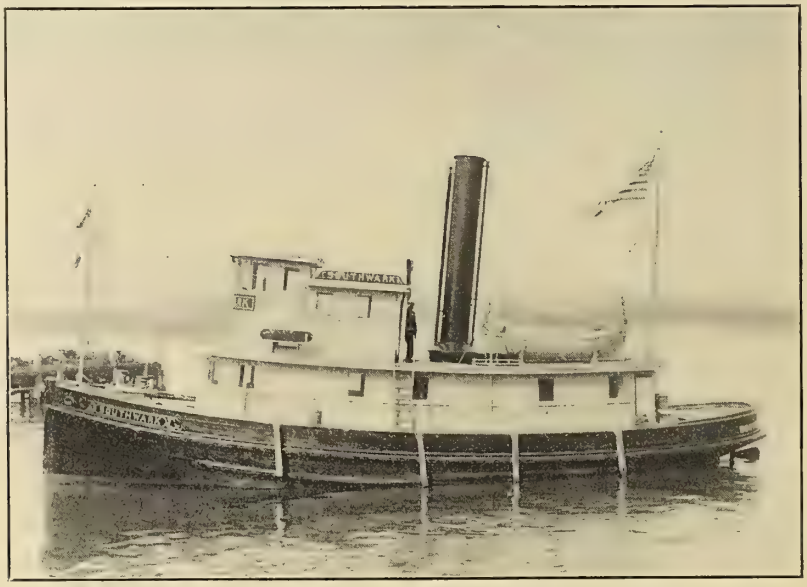
both oil and coal, but it was necessary for them to make frequent stops to replenish their bunkers.

During the *Honolulan's* passage, the only difficulty encountered was at infrequent intervals when water in the oil caused a little trouble. The engines were stopped but once, and that was at Punta Arenas. Had it not been necessary to cable, the *Honolulan* could have steamed the entire distance without stopping. The vessel's quadruple expansion engines, 25-inch, 36-inch, 52-inch and 76-inch by 54-inch, worked as if they had been in service for months. As a matter of fuel economy and for the purpose of not overworking the machinery, the *Honolulan* was run at reduced speed during the greater portion of her passage. Only two of the three boilers were used during this time and, with two boilers at 62 revolutions, she averaged 11 knots. Under three boilers at an average of 70 revolutions the steamer ran between 12.5 and 13 knots. Three boilers were in service while she steamed through the Strait of Magellan, where the maximum power was desired, and also north of the equator in the Pacific.

She is equipped with a wireless, 2-kilowatt, 60-cycle plant. On the Pacific the longest distance at which direct communication was maintained was with the shore station at Los Angeles, 1,400 miles away. On the Atlantic, considerable static disturbance was encountered, but none in the Pacific. Probably the most remarkable feats in wireless achieved was that done by the *Honolulan* when she was a long distance off the Mexican coast in longitude 110 West. The Ward liner *Merida,* when in the Gulf of Mexico, was picked up at a distance of about 1,000 miles. The *Merida* took the *Honolulan's* message, transferred it to Cape Hatteras station, and, in turn, it was relayed to New York; the *Honolulan* thus reporting herself to her owners when thousands of miles away. The remarkable feature of this feat was that between the two steamers, on the Isthmus of Mexico, was a mountain 17,000 feet in height, which did not seem to interfere with the aerial waves.

Approaching Puget Sound, the *Honolulan* got splendid results with the submarine signal. She picked up the bell submarines on the Columbia River and Umatilla Reef lightships

STERN RUN OF ARGENTINE DESTROYER.



TUGBOAT SOUTHWARK, BUILT BY THE WATERS-COLVER COMPANY.

at a distance of from nine to fourteen miles. This system is now installed on all of the American-Hawaiian liners on the Pacific Coast, and it is found of great value in waters where foggy weather frequently prevails.

Argentine Destroyer Mendoza.

The Argentine destroyer *Mendoza* was launched a few weeks ago in a French shipyard in France. Considerable spec-

ANOTHER VIEW OF ARGENTINE DESTROYER.

ulation seems to have been awakened concerning the shape of the stern of this destroyer, and this feature is clearly shown by the two illustrations which we give.

The builders expect to obtain a speed of 34 knots, although the contract speed is but 32 knots.

The dimensions are as follows:

Length over all	289 feet 8 inches
Breadth	28 feet 3 inches
Draft, aft	17 feet 1 inches
Displacement on trial	950 tons

High tensile steel is used in the hull, and she is galvanized up to and a little above the waterline. Four White-Foster boilers and two Rateau turbines, delivering 18,000 horsepower at 650 revolutions per minute, make up the motive power. The boilers can be fired with either coal or liquid fuel. The air pressure in the boiler room is 5 inches water gage. The lines of the hull are most perfect and account in a large degree for the satisfactory speed. The armament consists of four 4-inch quick-firing guns and four 20.86-inch torpedo tubes.

Two Tugs for Philadelphia.

The two new tugs built for the Department of Wharves, Docks and Ferries of the City of Philadelphia have been delivered by the builder, the Waters-Colver Company, West New Brighton, Staten Island.

These tugs were built complete, including the engines and machinery. They were delivered to Philadelphia the opening day of the inside route between Philadelphia and New York. The *Kensington* is the larger of the two tugs, being 65 tons, built of wood, 81 feet long, 20 feet breadth and 9 feet depth. She is equipped with a compound fore and aft engine 12 x 26 18 inches, has one Scotch boiler 10 feet 6 inches by 10 feet. The *Southwark* is a 42-ton tug constructed of wood, 66 feet long, 16 feet breadth and 7 feet depth of hold. She is equipped with a single engine 14 x 14 inches, with one marine leg type boiler 5 feet 6 inches by 10 feet. On the day of the trial trip, the *Kensington* developed a speed of 13.9 miles per hour, much exceeding the contract requirement of 10.5 miles.

High-Speed Ferryboat Kennedy.

This high-speed vessel was built and engined by the Willemette Iron and Steel Works, Portland, Ore., and the exacting demands of her contract were most cleverly met by the works. She is a vessel 190 feet long, 28 feet beam and 12 feet depth of hold, designed for a daylight passenger boat, operating on a run 16 miles long, from Seattle to Bremerton. It was desired to have the maximum passenger accommodation on a limited displacement. The contract called for a speed of 20 miles per hour to be maintained for four consecutive hours. The vessel has a displacement of about 450 tons and has pas-

HIGH-SPEED FERRYBOAT KENNEDY.

senger accommodation for 900 passengers. The nature of the service required of the *Kennedy* is such that the United States inspectors consider her in the class of a ferryboat and give her passenger license accordingly. In the calculations for

powering the *Kennedy* it was estimated that 2,000 horsepower would be required to maintain 20 miles per hour with a safe margin.

The space available for boilers was about 13 feet by 30 feet, and the problem of installing satisfactory boilers in this space was a serious one, particularly as forced draft was not possible. The Ballin watertube boiler seemed to fit the space conditions. It was decided to install two of these boilers of 4,000 square feet of heating surface each.

The engines for the *Kennedy* were designed for 2,000 indicated horsepower, the cylinders being as follows: High-pressure, 18; intermediate-pressure, 27; low-pressure, two, 34; stroke, 24 inches; working pressure, 250 pounds.

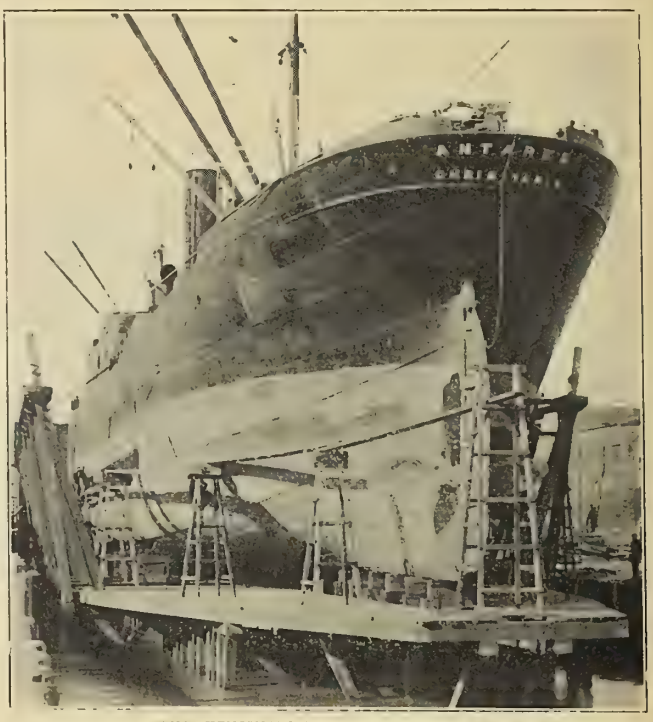
On official trial trip, the *Kennedy* developed 2,300 horsepower at 205 revolutions per minute.

Electrically Controlled Railway Drydock.

The Kensington Shipyard Company of Philadelphia, which is the repair department of the Wm. Cramp & Sons & Engine Building Company, has just added to its equipment a new Crandall railway drydock.

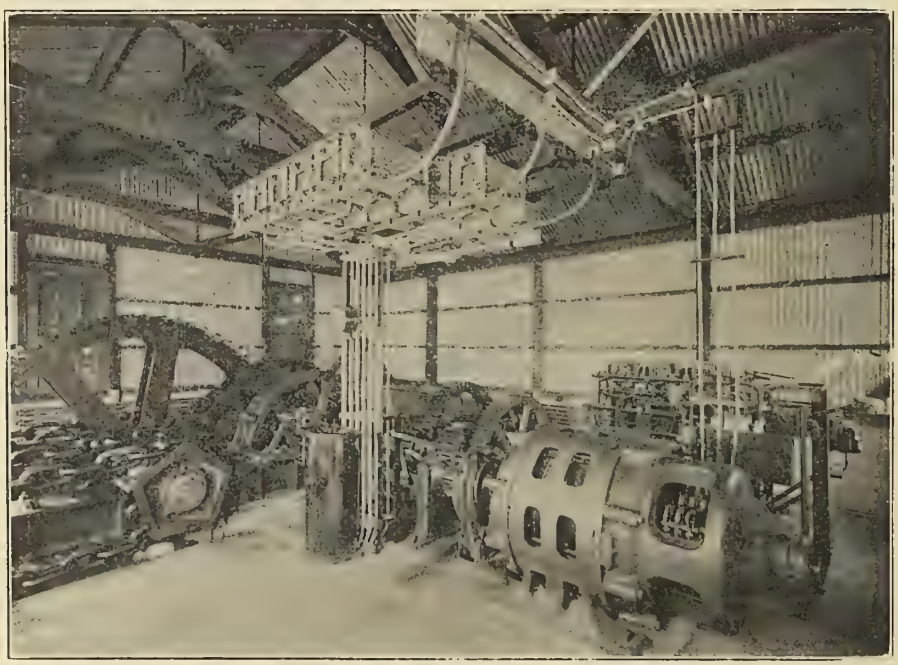
The project of getting an additional drydock at the Kensington yard involved the question of which type would be most suitable for the class of work to be done, and for the limited space available for its installation. After considering the three prevailing types of drydocks, the railway drydock was decided upon, since it could be installed within the limited space in such a way that vessels, while being docked, would be inside of the adjacent piers, and also without encroaching too far upon yard room.

The new drydock is 270 feet long, on keel-blocks; 290 feet long over the floor; 58 feet wide in the clear, and has a capacity of 2,500 tons displacement. The cradle travels on four tracks on the flat rail and roller method. The foundation is of piling, driven to bed rock, or to a hard-pan overlying the rock. The dock is constructed mainly of yellow pine timber, braced and trussed in a very substantial manner. The cradle is equipped with a full set of patent releasing bilge blocks. The lifting of the dock is accomplished by four heavy chains of the Crandall special type, equipped with a patent compensating device, which assures equal strains on all the chains. The chains are arranged on the endless system, working over sprocket wheels, driven by a powerful geared hoist. The power is furnished by a 225 horsepower electric motor, using



THE KENSINGTON RAILWAY DRYDOCK.

2,200 volts, capable of hauling largest loads in twenty-five minutes. With one exception, this is, so far as we can learn, the largest electrically driven railway drydock in existence—that one exception being a 4,000-ton similar drydock at Piraeus, Greece, designed by the same firm, and having a 300 horse-



ELECTRIC POWER PLANT OF KENSINGTON RAILWAY DRYDOCK.

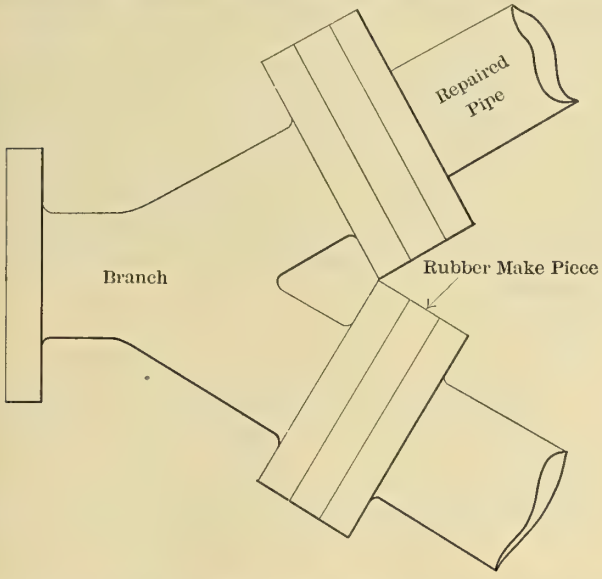
power motor. The official test of the new drydock was made when the steamship *Antares*, 279 feet long, was hauled up in twenty-one minutes. The entire work was designed and built by H. I. Crandall & Son Company, East Boston, Mass. The chains were made by Messrs. Bradlee & Company, of Philadelphia, and the electric equipment by the Westinghouse Electric and Manufacturing Company.

PRACTICAL EXPERIENCES OF MARINE ENGINEERS.

Incidents Relating to the Design, Care and Handling of Marine Engines, Boilers and Auxiliaries; Breakdowns at Sea and Repairs.

Broken Sanitary Suction Pipe.

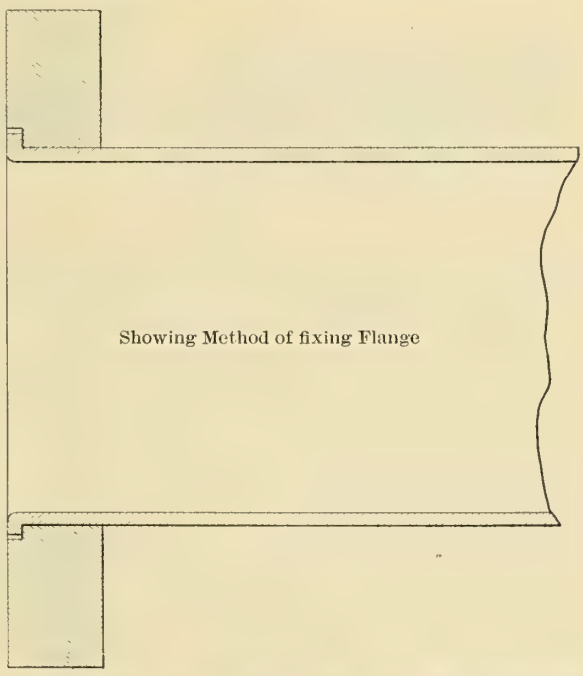
On the ship I was on we had direct acting sanitary, as well as bilge, pumps, worked off the arm of the air pump levers. The pumps, two on each side, kept the sanitary tank, wash deck, and fire connection pipes full at sea, whilst we had an independent duplex pump for the work in port. Each pump was supplied with the regular pet cocks to admit a little



THE SUCTION VALVE.

air, as is usual with all pumps, but as plunger pumps worked off the air pump levers are naturally dependent upon the speed of the engine for their number of strokes per minute, an unequal supply of water is the result. Especially so is this the case when the engines are racing at all. The pet cocks set for normal speed, therefore, may hardly be enough for such times and a slight "knock" is occasioned.

Three days out from New York one trip we ran into very heavy weather in the Atlantic, and the engines were racing just as much as two Aspinal governors would allow them, when the propeller was bared. There was a little knock in the pot pump, but as the plunger was making uneven strokes, due to the racing, and then drawing up, of the engines, the engineer at first took little notice of it, but a few minutes afterwards a louder knock and a rapidly filling port bilge made the same man investigate a little more fully. The donkey pump was started on the bilge, as the water was gaining on the direct acting bilge pumps rapidly, and it was then found that water was pouring out of the suction pipes for the sanitary pump. The suction valve on the ship's side was shut, stopping the rush of water, and it was found that the two pipes, one leading to each pump and joined to a branch at the ship's side valve, had broken off close to the flanges. In each case the flange of the broken pipe was left bolted on to the pump chamber. It was surmised that the pet cocks had become choked and caused the damage; anyway, there was heavy vibration in the suction pipes, tending to draw them apart. Ours was a passenger ship, and the independent sanitary pump was inadequate to keep the sanitary tank full at sea, maintaining a proper salt water supply throughout the ship, so the repair had to be accomplished at once. When completed, it remained as it was for two months, and until we arrived at the home port and had two new pipes fitted, the rubber makepiece we put in, as explained below, taking up what vibration there was. The pipes were 4-inch copper pipes with 7/8-inch flanges. The edge of the

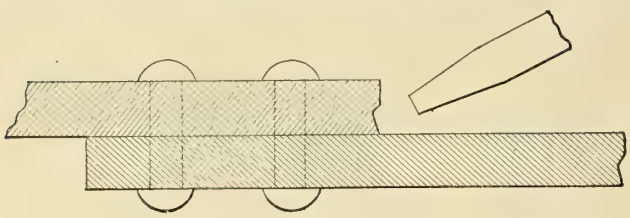


broken pipes was filed straight, and the two flanges were filed out in the hole large enough to allow the pipe to go through. The pipes were then fitted in the flanges, and beaded over, the flanges being beveled on the face side in the hole, and recessed the thickness of the pipe, as in the sketch, to allow for this. The pipes were too thin to think of cutting a thread on them, so we resorted to the preceding method of fixing the flange, which we squared up in the process of riveting and beading over. The pipes had broken off at the flange, and allowing for filing-up straight, and about 1/8 for beading over, the distance to make up when connecting was about 1 1/4 inches. The distance piece was made of rubber, and this we accomplished by utilizing two of the spare rubber valves, used for the large independent donkey bilge-pump, cut to size and punched for bolts. The valves were just over 1 inch in thickness, so we had to use a piece of 1/4-inch rubber jointing also, and when bolted up we put another stay on each pipe. As the pipes were for different pumps, two engineers were able to work on each, allowing the job to be done much quicker than otherwise. It made a good solid job when completed, and, considering all things, did not take long to fix up. H. W. H. K.

Welding and Calking at Sea.

A good many engineers at sea are sometimes at a loss to distinguish between iron and steel when they see it, and are therfore not sure whether it is possible to weld a broken article with the means at their disposal. It is therefore just as well in passing to mention for the guidance of young

engineers that cast iron is simply iron ore smelted and contains a very large amount of carbon; it cannot, therefore, be welded. It is possible, however, to burn two pieces together, but this cannot be done on an ordinary tramp steamer. Wrought iron is cast iron which has been puddled; by means of this process the bulk of the carbon in the cast iron is extracted, rendering the wrought iron capable of being forged or welded. Steel is pure iron with the addition of a smaller amount of carbon than is present in either of the two classes mentioned and it can be cast, forged or welded with facility. Cast iron is distinguished by its brittle fracture and



CALKING A SEAM.

gray color; wrought iron, by its fibrous fracture, and steel, by its close grain. It is also lighter in color than cast iron.

Welding is very seldom done in the engine-room at sea, and it usually turns out to be a failure, owing to some detail having been neglected. It is not, of course, to be expected that a heavy job such as a connecting rod or similar part can be welded at sea, but if care is taken it is quite possible to weld small parts of wrought iron or steel, such as firing tools used in the stoke hold. If this is done, considerable trouble may be avoided by repairing the rake and slices instead of using the spare ones and waiting until the ship arrives at home in order to send repairs ashore.

In order to weld or join together two pieces of iron or steel on board a vessel, they are heated to white heat, and sand is used as a flux before they are hammered together. For example, in order to weld, say, a rake shaft, the two ends which have to be joined together are heated (Fig. 1),

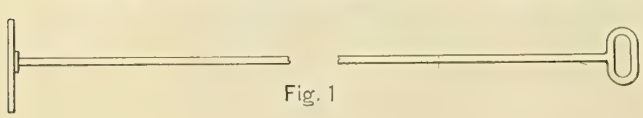


Fig. 1

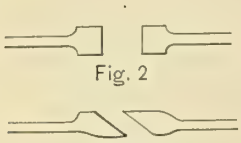


Fig. 2

Fig. 3

WELDING FIRE ROOM TOOLS.

and then they must be jumped up or thickened in diameter as shown in Fig. 2 in order to make sure of getting the rod down to its original size again after welding. The ends must then be scarfed, as shown in Fig. 3, and then heated to white heat; any scale that may be on the heat should then be knocked off, and sand should be sprinkled over the surface. As quickly as possible the two scarves must be hammered together and everything must be done very quickly, otherwise a bad weld will be formed. This is worse than useless, as after using the rake for a little while it will give way again and half of it will be left in the fire.

Attention may be drawn to another point: many engineers at sea have a very poor idea of calking the seams of a boiler, or what tools may be required. By calking is meant the closing up of the seam, either by riveting or upon the appearance of a leak. Such a leak is probably caused by excessive expansion, owing to the fact the water was not properly circulated in the boiler when steam was being raised. In the calking the edges of the plate are first chipped or planed in order to present a good, clean working surface, and then the calking tool is used. The ordinary tool aboard ship is just a blunt chisel about ¼-inch thick at the mouth and it is used to burr up the inner edge of the plate. A good engineer will, however, make for himself tools of different sizes and shapes in order to suit all kinds of work, such as calking round awkward corners and bends. If he attempts to use the ordinary tool for all classes of calking he is only damaging the plates to no purpose.

Stockholm. A Weld Calker.

Setting Propeller Blades on the Great Lakes.

On the freighters of the Great Lakes it is a common occurrence to break a propeller blade, and it is very handy to have a simple means to set the new blade to the required pitch. The simplest and handiest method I have used is a pitch board and straight edge. A common-sized wheel on the largest boats is 14 feet 6 inches diameter with 14 feet pitch. About 6 inches from the end of the blade is probably the best place to measure. One-twelfth of the circle makes a handy length pitch board. The base length of the pitch board should equal the chord of one-twelfth the circumference. To get it I use this method:

In the figure R = radius and r = chord.

Then $c =$

$$\sqrt{\frac{R^2}{2} + \left(R - \sqrt{R^2 - \frac{R2}{2}}\right)^2} : \text{if } = 81'', \ c = 41.9''.$$

Then our pitch board would be proportioned like Fig. 2. c c are clamped to hold the pitch board to the blade, and B

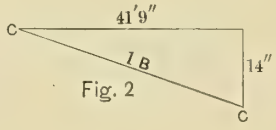


Fig. 2

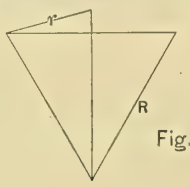
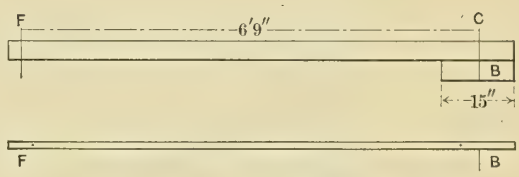


Fig. 1



TOOLS FOR SETTING PROPELLER BLADES.

is an angle bracket to keep it square with the blade. The straight edge should be made like the sketch, of ⅝-inch by 3-inch white pine, Fig. 3; f is a ¼-inch rod put through a hole drilled edgeways through the straight edge; c is a center, to fit the center in the end of the shaft; B is a bracket, to assist in holding the straight edge against the hub. Put the pitch board on the blade, and set the ends at 6 feet 9 inches radius with the straight edge, using the center in the shaft and the feeler rod. Then reverse the straight edge and hold the opposite edge against the hub, so that the feeler is at the edge of the pitch board. If the feeler touches the edge of the pitch board at each end the same, then the blade is correctly set. If not, move the blade around on the hub.

This method of using the straight edge seems to give better results than by sighting over the edge of a board to the straight edge laid across the hub. E. S. S.

Cleveland.

RECENT LEGAL DECISIONS

Injury from Slipping on Newly Painted Steel Deck of Vessel.

A laborer in the employment of an engineering company, while engaged in carrying two iron grate bars from a dock to the deck of a steel freighter, sustained injuries for which he sued his employers. The grate bars were carried to the deck for convenience of loading upon another vessel alongside. Two ladders were provided by the company, which were placed against the hull of the boat and about 25 feet apart, which the plaintiff was required to use. The top deck of the boat was constructed of steel plates, which had been painted prior to the day of the accident. The plaintiff had made about sixteen trips up the first ladder with iron grate bars, two at a time. The bars were 5 feet in length and weighed about 60 pounds apiece. He was then induced by the foreman to carry the grate bars up the second ladder. On reaching the top of that ladder it was necessary for him to step over a railing from 9 to 12 inches high. He was the first man to go on the second ladder, and as he stepped over the railing his foot slipped on the paint, and he was thrown to the deck, the two iron grate bars crushing his hand. He testified that the cause of his foot slipping on the deck was the fact of the paint not being set or dried, of which he was unaware and had not been warned.

The circuit judge directed a verdict for the defendant, but this was reversed on appeal. It was held that it was a fair question for the jury whether the deck was slippery because of the fresh paint, and thereby rendered unsafe and dangerous. The plaintiff was entitled to a safe place to work. If the place had been rendered unsafe by reason of its having been recently painted, and if the deck was covered with fresh paint so as to make it likely that plaintiff would fall or slip with his load, it was the duty of the defendant to warn him of the danger, especially where the appearances were deceiving.

Orso v. Great Lakes Engineering Company, Michigan Supreme Court.

Compensation for Designing and Superintending Construction of Yacht—Erroneous Admission of Evidence.

An action alleged as one cause of action that the plaintiff was employed to design and superintend the construction of a steel steam yacht for defendant (except the interior joiner work and fittings), for which he was to be paid 5 percent of the cost of the vessel. Defendant admitted the employment, and the jury fixed the cost at $87,685. Plaintiff contended that he was entitled to 5 percent on the cost of the small boats, forming part of the yacht's outfit, irrespective of whether or not he actually superintended the purchase of these. Upon conflicting evidence, the jury found in his favor, and that the cost was $5,900.

For a second cause of action plaintiff alleged that the firm employed in connection with the construction of the interior joiner work and owner's quarters, owing to their inexperience in naval architecture, encountered so many difficulties that they were forced to call upon him for assistance, and that defendant, the owner of the yacht, employed him to assist them, and that he did so. On conflicting evidence the jury also found in plaintiff's favor as to this employment, allowing him 3 percent on the cost of the work, which they found to be $27,970.99.

In reversing the judgment for a new trial the court said that it would have affirmed the judgment had it not been that a letter from defendant to plaintiff was received in evidence which related to the deckhouse, and not in any way to the second cause of action; and the judge of the trial court by error in his instructions to the jury referred to this letter as relating to this disputed matter.

Wells v. Baker, New York Appellate Division.

Performance of Contract of Sale of Anchors.

In an action for the price of twenty-five kedge anchors, amounting to $54. The delivery of the goods was admitted, the defense being that the sale was not a completed transaction, but simply part of a contract under which the plaintiff undertook to deliver five lots of varying sizes, but had only delivered one lot. The defendant claimed that the contract was entire and indivisible. The plaintiff proved that he had delivered all the goods contracted for, although he sued only for a part. It appeared that some of the anchors were returned to him by the defendant on the claim that its customer, the United States Naval Department, would not accept them. There was no proof, however, that the articles so returned were not in accordance with the specifications, nor was there any proof that there was any agreement that the articles were to be delivered subject to the approval of the Naval Department. Whether the contract was entire or divisible, there was proof of its apparent performance by the plaintiff. It was, therefore, held to be an error to dismiss the plaintiff's complaint.

Friedman v. Marine Manufacturing and Supply Company, New York Appellate Division.

Steamship Held Liable for Injuries to Contractors' Workmen.

A tank steamer contracted for repairs to be made on certain of its tanks. Before the work was begun it attempted to clean the tanks with live steam. After this was done, the contractors' servants appeared and were informed that the pump in one of the tanks was ready to be disconnected. While they were engaged in this work, with the aid of an open light, oil ran out from some portions of the pump, resulting in an explosion of gas, by which one of the workmen was injured. He libeled the ship for damages and obtained a verdict.

It was held that, the ship having undertaken preparation for the work, the contractors were only responsible for the method of doing it in the light furnished to them, and that the ship was negligent in permitting the contractor's servants to perform the work with open lights without warning.

The J. M. Guffey, District Court, E. D., New York.

Marine Engineer's Right to Have Fireman.

After part performance of an engineer's contract to operate a yacht, the engineer refused to continue unless he was furnished a fireman. This the owners refused to do. At this time there was no meeting of minds with reference to a rescission of the engineer's contract for the season. The owner procured a new engineer. The engineer left the boat without expressing any desire to continue the contract, merely intimating that he would stand on his rights. It was held, in a libel by him for wages, that, the original contract not having included the services of a fireman, unless subsequently agreed to, he was only entitled to recover for services up to the time of his quitting work.

The Imogene, District Court, E. D., New York.

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The great spur which urges man on to wonderful engineering achievements is the time element. We look upon the face of the earth as given us by Nature, and find barriers which, while small compared to the rest of the world's surface, effectually stop economical traffic between localities. To illustrate, the Isthmuses of Suez and Panama are typical. Through one of these strips of land a waterway has been cut, and the second is progressing rapidly. In looking over the past there seems to be little new under the sun; yet records are not found of the ancients undertaking much submarine work, nor do we find records of dredging to any extent. It does not seem hard to find the reason for this, as, with shallow draft and small vessels, deep channels were not required, and the Mediterranean Sea was practically the great navigable water of the known world.

In this month's issue we give accounts of dredges of modern construction and design, which we feel will interest our readers. In considering the condition of dredges and dredge work, we find that in Europe almost invariably dredges belong to and are operated by governments, in order to deepen harbors, keep them clean or open canals; while in the United States private enterprise owns most of the dredges, save in the Canal zone, and these two conditions have a very marked effect on design. In the governmental ownership the question is to get the very best possible article, as it is not to be used for making money directly, but indirectly, by giving the citizens of the country better means of communication with each other and their neighbors, thus inducing business. The result of this is that foreign dredges are of the highest efficiency and lasting qualities, and their first cost is not so closely considered as in the United States, where, on the other hand, the dredges, being private property, every consideration must be given to first cost, so that a fair monied return on the investment can be hoped for. Looking over the illustrations of dredges given in this issue, the solidity of the European makes becomes apparent, and yet we find that what might be termed the lighter-looking dredges of America are doing most satisfactory work. The part played by dredges in modern civilization is not appreciated by most of us. Just now the Panama Canal holds central place in dredge work; but the Cape Cod Canal and others, especially the New York Barge Canal, are by no means small undertakings, and they are only made possible by the modern dredge. Again, a considerable amount of the gold which is taken from the earth is obtained through the means of dredges. As the first cost of a dredge is large, it is of the utmost importance that the various parts be made substantial and lasting, for when a dredge shuts down it is like any other machine—a money consumer instead of a money maker. Recent advance in the manufacture of steel has enabled dredge work to be carried on with less interruption than a few years ago. If we can offer a criticism in dredge design, it is that the tendency to simply increase the cross-section or weight of a part that is broken or has given out could be advantageously changed by the study of a better form to resist strains and shocks rather than merely the brute-force ways of adding material.

—

We remarked on the internal-combustion engine in our April issue. Since then we have information that a battleship is being equipped with a prime mover of this type. The remarkable strides made in the use of this prime mover in marine work are quite enough to make us pause and ponder. If a thousand horsepower is to be developed in one single cylinder—and we are credibly informed that this is so—then 1,500 horsepower will soon be a fact. Without data, it is somewhat of a guess as to what diameter of cylinder these engines would have; but probably it would be in the neighborhood of 70 inches, and certainly it is a bold engineering undertaking to produce this. We feel that one thing in connection with internal-combustion engines as fitted to vessels should be borne in mind, and that is, their great economic value would seem to lie in their being able to propel a ship at a set speed from port to port, and not in their maneuvering powers,

Novel Salvage Operations.

For the first time in the history of salvage operations on the Pacific Coast, a floating, pontoon drydock, of handy size, has been successfully utilized to raise from an extreme depth a passenger and freight steamer. The method of using scows to raise a submerged object, taking advantage of the tides to raise the wreck, is no novelty, but in the present instance the practicability of a drydock operating independently of the tides has been thoroughly demonstrated. As the result of the success of this experiment, the steamer *Kitsap*, 195 gross tons, which sank in 240 feet of water in Seattle Harbor, following a collision, was raised.

Valued at $45,000 (£9,000), the *Kitsap* was insured for 80 percent of her value and after the accident was considered a total loss, owing to the great depth of water. However, the officers of the Elliott Bay Dry Dock Company, Seattle, believed that their dock could bring the *Kitsap* up, and when they offered to make the attempt the insurance companies were willing. The salvors were to be paid 60 percent of the vessel's appraised value after she was safely hauled out in drydock.

Two tugs were chartered to attend the dock, which was towed from its site to the scene of the wreck, where the dock was made fast with two anchors at one end, allowing it to swing with the tide. A one-inch steel cable was buoyed at one end and the other was swept under the wreck by the tug. This was no easy task, and it was not until the third day that the line caught. It held fast under the bow and the dock gave a lift, raising the wreck by the stem. Then a second cable of the same size was swept under the keel until it held fast some distance from the stern. A lift was taken by the dock with both cables, and the tugs towed dock and wreck inshore for about 150 feet. When the submerged hull fetched up against the sloping bank, one of the cables parted. In its place a 1⅜-inch steel cable was swept under the wreck and made fast. On the next lift, the second cable carried away and it was replaced by a second 1⅜-inch steel line. No further breaks occurred with the heavier cables, each of which was about 1,600 feet in length.

With the wreck held securely by the two strong cables, the dock was successively filled and pumped out. Each lift brought the wreck up about 19 feet, and while thus suspended from the dock, both dock and hull were towed into shoaler water, until the wreck brought up against the sloping bottom. When the weather was favorable, operations were continued night and day, from 6 to 12 men being employed. The longest tow accomplished at one time was 300 yards, and the entire distance the wreck was moved until it lay in 60 feet of water, where a diver could examine it, was 600 yards. Under favorable conditions, it was possible to make five lifts in 12 hours.

When in 60 feet of water, the wreck was first examined by a diver, who found the vessel lying on her bilge with a list to port. One cable was fast 30 feet from the bow, and the other 15 feet forward of the stern post. While the diver was making fast two other cables, the wreck was brought up to within 28 feet of the surface. Over the ends of each cable was slipped a heavy iron ring which dropped to the wreck and held it fast. When the four cables were fast and everything secured, the hull suspended from the dock was successfully towed across the bay, a distance of three miles, to be beached for temporary repairs.

With each lift the cables, which were brought up over the wings and made fast on top of the dock, were drawn taut, the necessary tackle being on the dock. The bottom of the bay is covered with three or four feet of mud and at a depth of 40 fathoms, with a square inch pressure of at least 90 pounds, it required immense power to move the steamer, especially from her original position. However, the dock showed no indication of strain and was not leaking after performing this notable salvage feat. The *Kitsap* is a single-screw, wooden vessel, built at Portland, Ore., with the following dimensions: Length, 127.5 feet; beam, 22 feet; depth, 7.5 feet; gross tonnage, 195, net, 123. The dock is 140 feet in length, with a beam of 34 feet 6 inches, a capacity of 600 tons and a lift of 19 feet. The pumps are operated by two 16-horsepower Union gasoline engines. R. C. H.

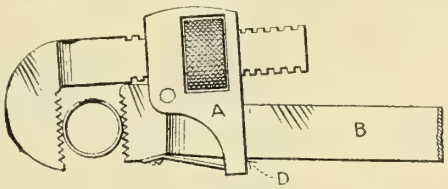
Seattle.

Laws Concerning Wireless Telegraphy.

After July 1, 1911, all ships leaving American ports must be supplied with wireless telegraphy, provided they carry 50 passengers or more, unless the voyage is under two hundred miles. The requirements are that the apparatus will have to have a radius of at least one hundred miles, and the operator be able to send and receive at least twenty words per minute, five letters being counted as a word; and he must be conversant with the international regulations applying to wireless traffic and be able to write legibly. He must hold a certificate issued by the United States Government, certifying to his ability to adjust wireless apparatus, and be "skilled" in its use in the true meaning of the word. At the present time, the awkward condition exists that, while the Act of Congress appropriated money to carry out the examinations of operators, it is not available until the first of July. This will probably result in vessels not being able to comply exactly with the law, as it would be hardly possible to obtain certificates under the circumstances by that date, but, at least, all the apparatus can be installed.

How to Use a Pipe Wrench.

Every engineer knows that a pipe can be easily jammed by a pipe wrench, but if my instructions are carried out, one can be used on even thin pipes without jamming them, says a correspondent in *Power*.



Place the wrench on the pipe and get it to bite; then slack off on the nut until the frame *A* comes in contact with the handle *B*, at *D* (see illustration), thus preventing the jaws from closing; the wrench then has power to turn, but not to jam the pipe.

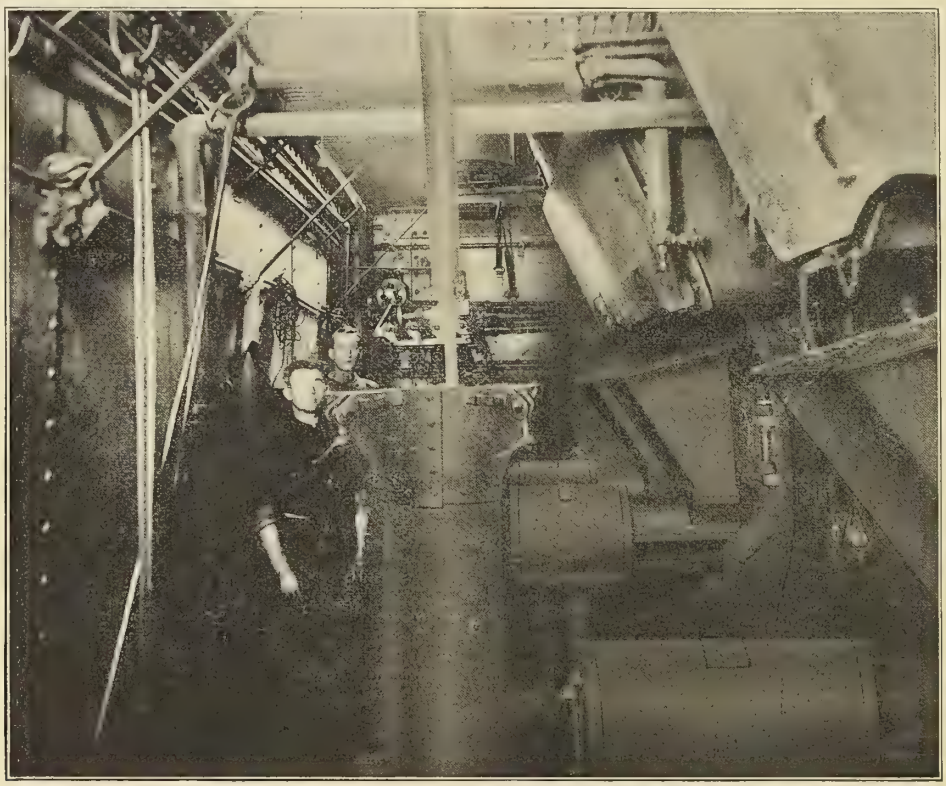
In Determining Owner's Liability for Injuries Chief Engineer of Yacht Held Fellow Servant of Oiler.

An oiler on a steam yacht was injured by slipping on an alleged defectively guarded platform. He admitted, in an action by him against the owner for damages, that he voluntarily continued to work on the platform after he became aware that it was dangerous. He stated, however, that the chief engineer had promised to fix it. It was held that the chief engineer on a vessel, like all the rest in the service of the owner, except perhaps the master, was a fellow servant of the oiler, in the absence of direct authority to represent the owner, and that therefore the oiler could not recover.

Hollis v. Widener, Pennsylvania Supreme Court.

The Nicholson File Company, Providence, R. I., has just issued a catalogue regarding its product which deserves the most favorable commendation. We believe it to be the finest catalogue, not only in design and layout, but in printing, that we have ever seen. The many files and other product of this company are illustrated in the most perfect manner, making it, we believe, a most valuable work of reference on the subject of files, rasps, etc. The Nicholson File Company is to be congratulated upon its business foresight in issuing such a splendid catalogue.

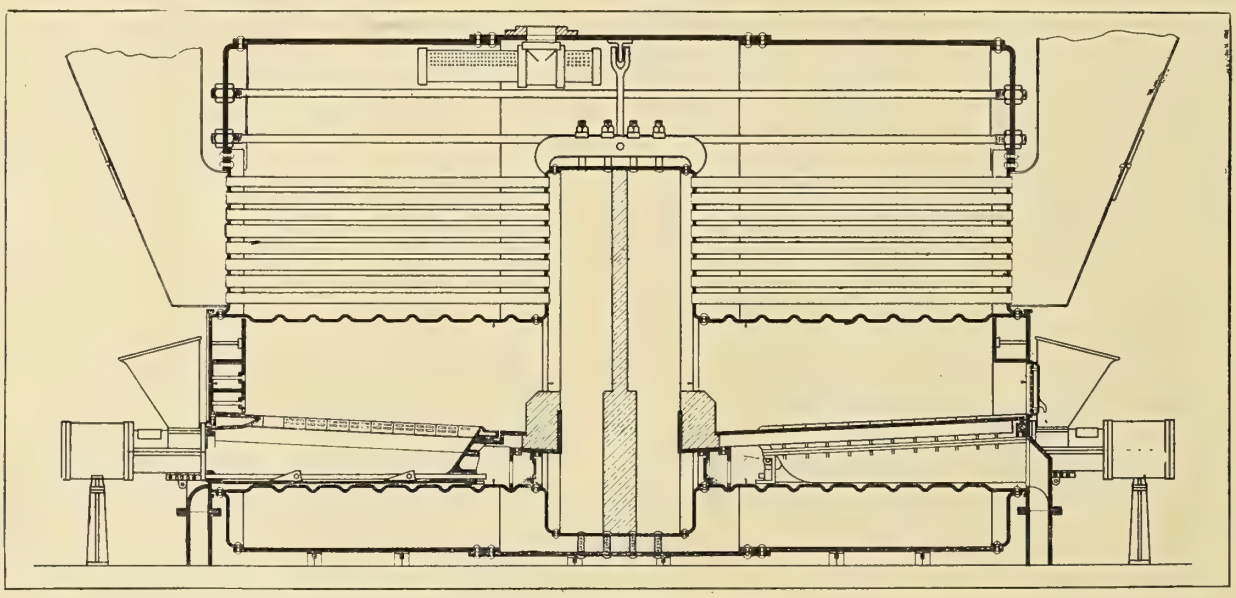
Mr. Axel Holm, who has been connected with American shipyards for some years, has accepted an offer to become assistant naval architect at the Copenhagen-Denmark Floating Dock & Shipyard.



DREDGE BOILERS EQUIPPED WITH JONES STOKERS.

The Jones Stoker as Applied to Dredges.

When the city of Chicago decided to increase the area of Lincoln Park by dredging and filling, the question of a proper dredge was a very serious one, and, after the dredge was installed and working, the smoke from it became embarrassing and the commission suffered from all the ills of excessive smoke, which was complained of loudly until the Jones Stoker was installed. We give a line drawing of this



PLAN OF STOKER EQUIPPED BOILERS.

Naval Constructor William J. Baxter, who has been transferred from the New York to the Boston navy yard, will leave a host of friends who will miss him greatly.

stoker as fitted to the boilers in the dredge; also a half-tone showing the fire room. The Jones stoker is made by the Under-feed Stoker Company of America, Marquette Building, Chicago. Besides getting rid of the smoke, which was such an important matter, the economy in the use of the stoker was a surprise, and satisfactory to the commissioners. Before it was installed, coal was being paid for at the rate of $3.75 a ton (15s.), and after the stoker was fitted, coal at $2.35 (8s. 5d.) was found to be equally good for steaming. The repairs for an entire season on this stoker were reported by the commission as considerably less than $5 (£1). This certainly may be considered excellent, and the small amount for up-keep is the best evidence of the construction, lasting qualities and practical working of this stoker.

Improved Kerosene Torch.

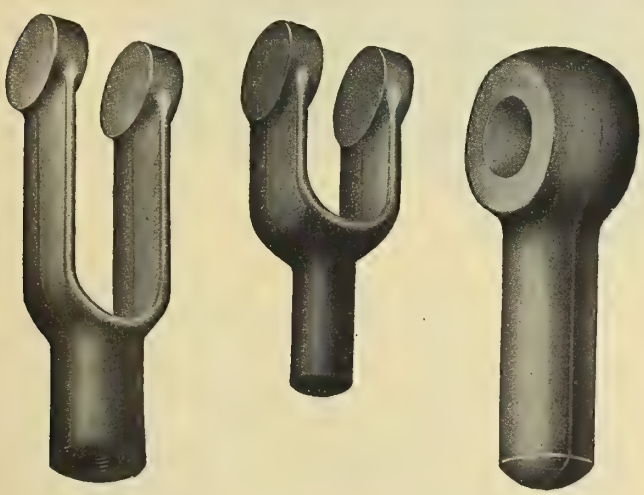
Oil as fuel for many purposes gains daily, and of all oil products kerosene is probably the most widely known and distributed. Taking advantage of this, as well as other points, the Hauck Manufacturing Company, 140 Livingston street, Brooklyn, N. Y., has placed on the market a kerosene torch.

NEW HAUCK KEROSENE TORCH.

Certainly the use of kerosene appeals to many on account of no insurance restrictions, its safety and ease with which it can be obtained, cheapness and safety. The uses to which this torch can be applied are almost endless, in general shop work. The torch is so constructed as to keep the tank cool, and only small pressure is required to operate it.

Stub Yoke and Rod Ends.

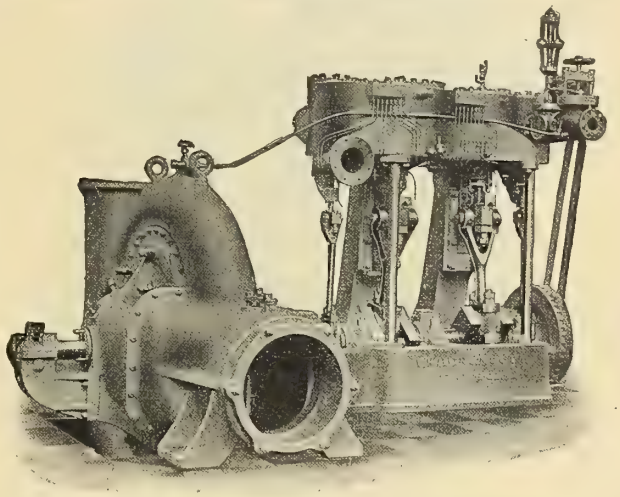
The Billings & Spencer Company, Hartford, Conn., is putting on the market the new design in yoke and rod ends here shown. It is expected that this new pattern will prove popular with the motor boat builders. This design permits of the greatest possible radius of action, maximum strength and minimum weight. The short stub end is rounded to facilitate electric welding. All are furnished either in blank, milled or assembled, and in various sizes, as listed in the pocket-size booklet issued by this company.



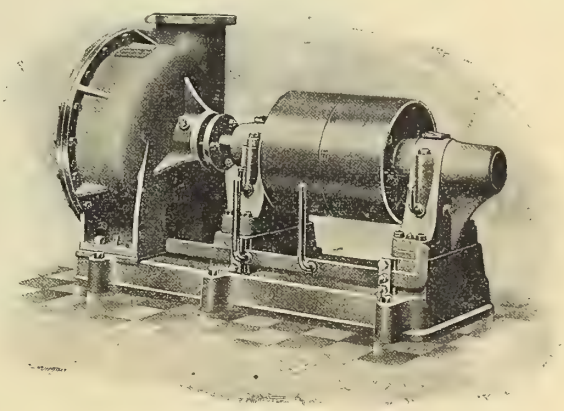
BILLINGS & SPENCER YOKE AND ROD ENDS.

Allen Centrifugal Pumps.

To those who go down to the sea in ships, the great prerequisite for all appliances is reliability. Sailor men are accused of being slow in taking up new things, but it is not fair that this should be so. A false move, a poor selection, may mean the death of many, and great loss of money. It is this feeling of reliability which makes the appliances of W. H. Allen, Son & Co., Ltd., Bedford, so popular. In this mechanical production, the design gives the idea of solidity and lasting qualities. Their Conqueror centrifugal sand pumps, which we illustrate, are used for handling crushed quartz, etc., where such products are mixed with water. Such work is, of course, very destructive and wearing. It is only by the use of special materials, care in design, that lasting qualities of such pumps as these can be accomplished. Owing to the difficulty of working manganese steel, Messrs. Allen use instead a high grade of cast iron, which has all the necessary value of homogeneity. The section system of liners reduces the cost of up-keep on these pumps. What is best in material and design takes time to determine, and by a number of experiments and proper records the above company has carefully

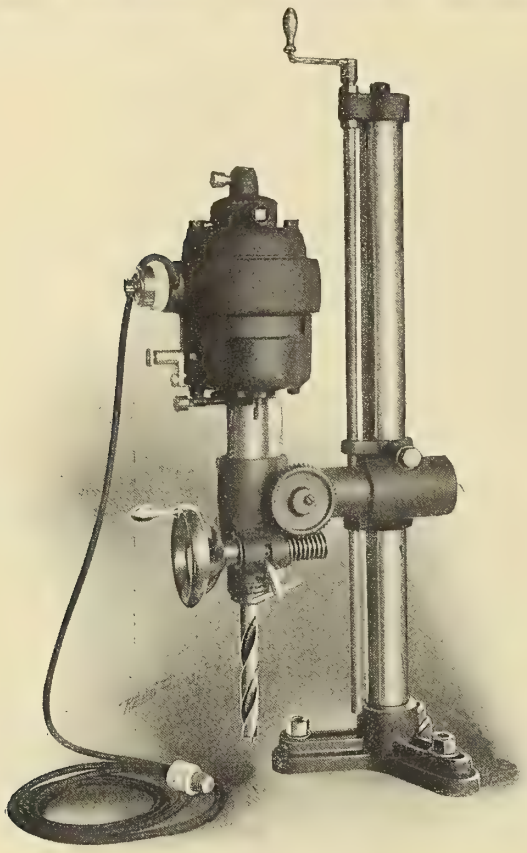


ALLEN ENGINE AND PUMP.



ALLEN CENTRIFUGAL PUMP.

worked out the difficult problems which are presented in the case of sand pumps. Their engines are sold singly or



LAMB ELECTRICALLY DRIVEN DRILL.

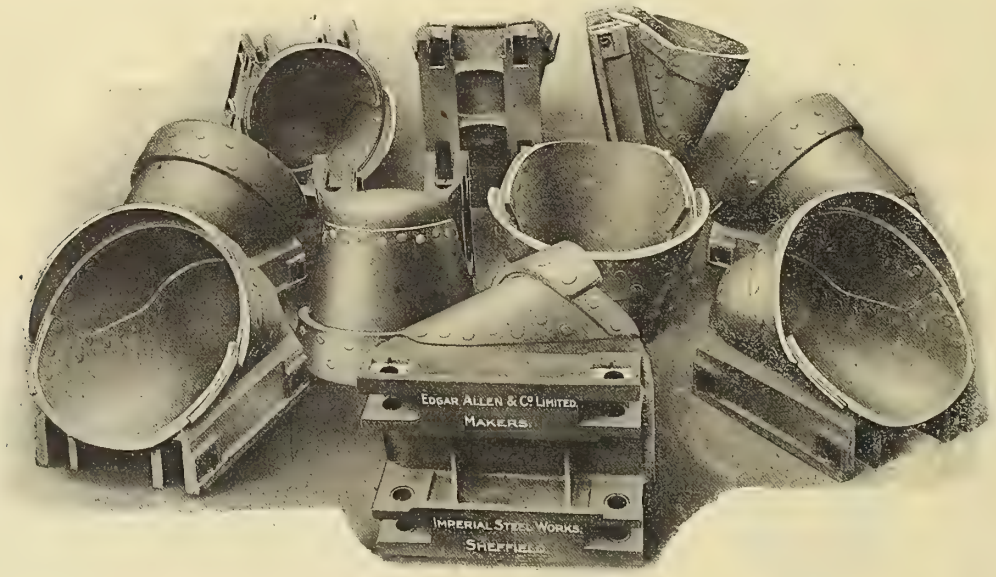
coupled with their pumps for the above uses or for ship use. They make these pumps from 4-inch suction up to 18-inch suction, and they can be adapted for belt drive or electric drive as the necessities of the case demand.

Lamb Portable Electrically Driven Radial Drill.

The Lamb Electric Company, of 20 Huron street, Grand Rapids, Mich., has perfected a convenient electric-driven radial drill, which we illustrate. The application of electric drive in this drill simplifies the construction, so that while there is ample power to drive a 1-inch drill and feed it to its work properly the weight is only 125 pounds to 150 pounds, depending on the current available. The feed is through a worm and wheel, pinion and rack, and a quick return is provided when wanted; the thrust is received on ball bearings, the column is made of steel tubing, and is 2½ inches diameter. As usually made the following is the range of work: Twenty-eight inches from spindle to base, 8¼ inches from center of spindle to column, travel of spindle is 5 inches, and the hole in same is No. 3 Morse taper. The extreme height of the drill is 40 inches. One convenient feature of this drill is that it can be fitted for two speeds, and to make the change only a button has to be pushed. The radial feature makes it most convenient. The range, as above given, can be altered to meet requirements.

Steel in Dredger Work.

Dredger makers and dredger users have cause to thank the steel maker for the increased efficiency of modern dredgers. It is a matter of no small difficulty to find the most suitable steels for all the various parts of a complete machine. For instance, take the use of manganese steel. This steel is exceptionally tough and resists abrasion to a high degree. Although so hard that it cannot be machined, it is, at the same time, so tough that it can be bent double while cold without showing signs of fracture. It has been found invaluable for dredger work, for pins and bushes, links, tumblers and bucket lips. We reproduce an illustration of some buckets made by Edgar Allen & Company, Ltd., of Sheffield, which shows very clearly the method of attaching these lips—the steel for the lips being their Imperial manganese steel. Dredger parts made of manganese steel wear longer than when made of the best quality of ordinary hard steel, thus reducing the up-keep cost enormously.

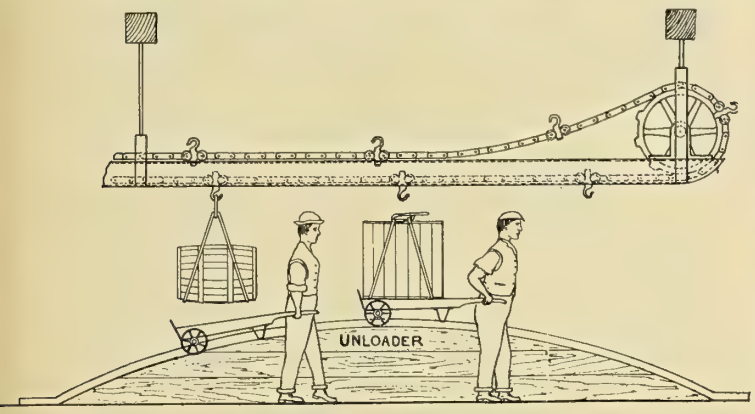


EDGAR ALLEN STEEL DREDGE FITTINGS.

The Reno Freight Carrier.

We illustrate the Reno freight carrier, a device which can be fitted in warehouses, on steamship piers and at railroad terminals, for the rapid handling of freight. It is manufactured by the Reno Inclined Elevator Company, of 555 West Thirty-third street, New York, U. S. A. The machine consists of an endless chain of special construction provided with pivoted

hooks, which are carried by small iron wheels, which roll upon the flanges of a pair of channel beams bolted together and spaced about 1 inch apart, thus forming a strong truss frame or carrying track capable of spans of considerable length. At each end the chain passes over a sprocket wheel, and these wheels can be driven by motors in either direction. The



RENO FREIGHT CARRIER.

method of loading is illustrated very clearly. Probably no machine on the market will perform more operations than this one.

Howden Draft for Dredges.

While the question of turbines or cylinder engines is being considered with a view to economy, we are constantly seeing more and more efforts directed towards heating the feed-water of boilers or the steam itself by superheating, and we strive to perfect our boilers in every possible direction by more perfect design and superior material, yet, when we come right down to what is the initial point, it is the consumption of fuel. A good boiler can show very poor results if the coal is not properly consumed, and in order to do this we must have air, and this must not cost us so much that we waste a "pound to save a penny." To handle air is a study and not one which can be taken up in a few hours and thoroughly understood. Experience is an expensive teacher, but it is, as a rule, thorough. We go to a doctor when ill because he has made a study of our bodies, but in business we are not apt to be so wise, especially in engineering. To know how to use air under our boilers we should go to those who have made a study of it, and Messrs. James Howden & Company, Ltd., of Glasgow, probably have had a more extended experience in this line than any other firm in the world. The constantly increasing demand for their product is good evidence that what they undertake is well done. Many of the dredges referred to in this issue are fitted with the system of the above company.

Repairing of Dredger Buckets with "Thermit."

The "Thermit" welding process is of value in dredge work. A welding outfit consists of a supply of welding compound, a suitable sized crucible, a mould built around the part to be welded, and suitable arrangements for drying the mould and preheating the job. The "Thermit" process consists in fusing the broken parts by means of extremely hot molten mild steel, produced in the crucible from the welding compound. The compound is ignited by means of a special ignition powder which produces the necessary temperature to start the combustion of the compound, and in about 30 to 45 seconds the reaction is complete, with the result that half of the weight of the compound is produced in the form of highly superheated liquid mild steel, the remainder being slag.

A brief description of a repair to a large dredger bucket will be interesting. The fracture—which extended for about 18 inches—was opened an inch, so as to allow the molten metal to more easily fuse the parts, and to form a connection between the metal band on each side. All scale, rust, etc., was removed; a wax pattern was formed each side of the fracture and coated with plumbago, the bucket was placed in a bed of moulding sand, and the facing sand rammed hard against the wax pattern. The holes for preheating and for the runner and risers were made off wooden patterns. A preheating torch was applied to the heating hole, and this melted out the wax, thus leaving a space for the liquid metals to flow into. The preheating was continued until the parts were red-hot. In the meantime the crucible was rigged up over the runner, charged with the welding compound. On removing the preheating torch the hole was securely filled with a dry sand plug, the compound ignited, and in about 45 seconds the crucible was tapped, allowing the molten metal to flow into the mould. After cooling, the mould was removed, and the runner and risers cut off. The repair proved very satisfactory, and after twelve months' service the bucket, upon inspection, was found to be in exceedingly good condition. It is asserted that when repairs are made by the "Thermit" process the welded part is stronger than before the breakage occurred. The process is equally suitable for repairs to stern frames, rudder posts, etc. Broken iron castings can be welded when due allowance can be made for contraction stresses. The

A THERMIT REPAIR JOB.

"Thermit" metal combines equally well with either cast, wrought iron or steel. It is manufactured by Thermit, Ltd., London, E. C., and Goldschmidt Thermit Co., 90 West street, New York.

Mr. Louis L. Bernier, the well-known marine engineer, has been engaged by the Sanitary Water Still Company of Jamaica, L. I., and Washington, D. C., to take full charge of its marine department for the sale of evaporating plants and feed water heaters.

TECHNICAL PUBLICATIONS.

Ship Turbines. Dr. Bauer and O. Lasche. Size, 8 by 5 inches. Pages, 200. Illustrations, 104. Munich: R. Oldenbourg. Price, 8 marks in Munich.

No work on the subject of turbines which we can recall goes more minutely into this very interesting subject, and gives clearer information. It might be said that with this work at hand the engineer could feel he was equipped to undertake turbine work in any of its details. The illustrations are so many that they almost explain the test to those who do not read German. The authors are to be congratulated.

Die Schiffsschraube und ihre Wirkung auf das Wasser. Oswald Flamm. Size, 11 by 7½ inches. Pages, 23. Illustrations, 116. Munich: R. Oldenbourg. Price, 10 marks in Munich.

This work by Dr. Flamm is very remarkable. By means of photography the effects of various forms of propellers are

most clearly shown under many varying conditions while actually propelling a boat. The subject is admirably treated, and the information given added greatly to our knowledge of what goes on under water.

Record of American and Foreign Shipping. Size, 8 by 9½ inches. Pages, 1,018. Illustrations. Tables. New York, 1910. American Bureau of Shipping.

The volume for 1911 of the "Record of American and Foreign Shipping," American Lloyds, published by the American Bureau of Shipping, 70 Beaver street, New York, is its 43d volume.

The record contains full reports and particulars of vessels of all classes and nationalities training with the United States, Canada and southern countries. It also contains rules for the construction and classification of steel, iron and wooden vessels; rules for survey of machinery and boilers for vessels; provision for the installation of electric lighting and power apparatus on shipboard, and much other valuable information of special importance to underwriters and all firms or persons interested in shipping. These rules are recognized and accepted by the United States Government.

Besides the usual full information for the benefit of subscribers in the way of rules for construction, with their accompanying illustrations and tables, all of the utmost practical and technical value, the work contains such features as list of addresses of prominent shipbuilders, dry docks, marine railways, marine machinery and boiler constructors of the United States; list of vessels whose names have been changed; also compound names indexed as per last name, names and addresses of owners of vessels classed in the record.

This record of shipping is the only book now published containing reports and particulars of all American vessels, and the reports in detail of repairs to wooden vessels still in existence should be of special value to underwriters.

The work has the approval and is endorsed by the important boards of underwriters in the United States, and is accepted throughout the world by those interested in shipping as a standard register and classification of vessels.

Machine Shop Mechanics. By Fred. H. Colvin, A. S. M. E. Size, 5 by 7 inches. Pages, 172. Illustrations, 116. McGraw-Hill Book Company, New York-London. Price, $1.10 (4/6).

Some people have a gift in imparting knowledge and putting things in a light which is clear, yet not dazzling, and Mr. Colvin in his "Machine Shop Mechanics" shows this enviable quality. He selects for illustrating his text every-day articles that the machine shop man sees and often wonders why such and such dimensions were used, and how the designers got at the sizes of various parts. And further, thinking machinists want to know what is "inside of things"; as, for instance, the hydraulic jack on page 116. If we could only get people to read and remember something they read and apply the knowledge, our work in the world would be more satisfactory. Most men, who are real men, do not mind hard work, but chafe under hard work without results. Mr. Colvin's little book will enable a certain class, and a large one, to accomplish more and not waste their energy and other people's time, and we hope, therefore, the "Machine Shop Mechanics" will have a wide sale. If the mechanic who has not had the advantages of a fair education will read Mr. Colvin's little book, there will be fewer perpetual-motion machines made in the world.

The Engineering Index Annual for 1910. Size, 6½ by 9½ inches. Pages, 496. New York, 140 Nassua street, *The Engineering Magazine*. Price, $2.00 (8/–).

The amount of time that can be saved by buying this book and keeping it at hand cannot even be guessed at. Every engineer should have it. The brief descriptions of books on all engineering subjects are admirable. A clear idea is given of the contents of each, and the compilers have evidently used every effort to make the work complete, and seem to have been most successful. Very few can appreciate the enormous amount of labor and care which must be given to get out a work of this kind. A new feature is introduced in this issue, adding to its convenience. It is the assembling of all catch words under their classified arrangement in the front of the book. This will be greatly appreciated. It would seem to us that the Index should be in the hands of every trade school, or, in fact, any educational institution.

Elements of Machine Work. By Robert H. Smith. Size, 5 by 8 inches. Pages, 192. Illustrations, 204, with tables. Price, $2.00 (8/–).

This work goes into the details of many operations which are seldom described in text-books, and is up-to-date in modern appliances. Whether it is the author's idea to thoroughly instruct or only suggest by this book, we are not sure, but we should think the former; as, for instance, there is a clear explanation of a power hack saw for cutting off stock, but it neglects entirely the fact that very often the hack saw does not cut straight, but "runs," as it is termed. Certainly, this fact is well known to every user of this convenient tool, and not to call attention to it, and show how to correct it, is an oversight. Taking the book as a whole, there is a great deal of information imparted, and it is well worth reading from the first to the last page.

Temperature Entropy Diagram. By Chas. W. Berry. Size, 5 by 7½ inches. Pages, 387. Illustrations, 125. Numerous tables. John Wiley & Son, New York-London. Price, $2.50 (10/).

This book of Professor Berry's seems very timely, as just now the matter of efficiency in steam and its generating and use is being most closely considered not only by those who are thoroughly familiar with the subject but by many who are badly handicapped by the lack of knowledge which is so clearly supplied in this book. While Professor Berry asserts that the work is by no means exhaustive, and is for the student of thermodynamics, we must say that less could not be said on the subject and that more is hardly necessary. In other words, it is difficult to conceive that the consideration of energy turned into mechanical work and its relation to heat and change of volume could be treated more clearly, and the study of this book will undoubtedly redound to the advantage of those who are groping in the dark for a light which is so admirably supplied.

Principles of Machine Work. By Robert H. Smith. Size, 5 by 8 inches. Pages, 388. Illustrations, 425. Tables, numerous. Boston: Industrial Text-Book Company. Price, $3.00 (12/–).

The amount of work entailed in bringing out this book is difficult to estimate. It is original, not being a "hodge-podge" of catalogues, but most carefully prepared, and the illustrations are admirable, being clear and well-chosen to lay before the reader "eye-explanations." Examples of work in the machine shop and how it is generally handled can be found for many cases, but, of course, it is not to be expected that in any such work every possible case can be shown and explained. Besides the ordinary run of work, many most convenient "dodges" are shown, such as how to tap large with a tap, how to get out a broken tap, etc. In some cases, the explanations, we think, are a little lacking, as, for instance, on page 336, how to locate the holes A and A′ is by no means clearly explained; it represents a double thread which finishes what is called "square"; that is, it does not run out, but finishes in the holes above referred to. The usual way to locate these is to gear the lathe, dog the work, and, with a threading tool, run a line for each thread and by this line

locate the finishing holes. We think that it is rather an oversight to practically neglect the milling machines in this book. It certainly deserves a place in machine work. In considering the book in general, we are not sure whether the good machinist who knows the trade thoroughly well, or the inquiring youth, will be most interested, but we do feel that the machinist will be most edified, as from its pages it would be impossible to learn the machinist trade without the adjunct of the actual tools, and with personal instruction, but it is certain that no clearer explanations, in most cases, could be made than found in this work of general machine shop work.

The Principles of Scientific Management. By F. W. Taylor, M. E., D. Sc. Size, 6 by 9 inches. Pages, 77. Harper & Bros., New York-London. Price, $1.50 (6/).

The natural inclination of man is to take it easy, or, to take the idea of Mr. Taylor, he is lazy. To set out to correct this is certainly a vast undertaking. Mr. Taylor's method to overcome this inherent quality of mankind is to pay more for more work done. The "Principles of Scientific Management" is based on the idea of noting with the utmost care and minuteness the time of operation or movement and to study the record so made, and by that study eliminate much, or rearrange the entire scheme. Mr. Taylor does not shut his eyes to the difficulties which are to be encountered in trying to improve mankind, but he takes a most hopeful view, believing that the spur which will force men forward in the race to their satisfaction and those who employ them is money gained. We can hardly agree with Mr. Taylor in many of his views. In fact, we think that he often makes comparisons between extremely poor showing of existing conditions and the very best rearranged conditions. This obviously is unfair in considering the general subject. For instance, he notes lifting 7½ tons of pig iron was a day's work. This he augmented to 47½ tons in the same time. Now, if men were unloading or loading pig iron at the rate of only 7½ tons in ten hours, somebody was woefully ignorant, or else negligent, in allowing such condition to continue. Twenty tons a day of loading pig iron we have often seen. Mr. Taylor makes the point that one of the great troubles in the world is lack of knowledge on the part of those who direct or, more properly speaking, who are at the head of large enterprises. This is an unfortunate fact, but it is hardly to be expected that anybody short of the Almighty should have the infinite knowledge of thousands of men.

We do not see that Mr. Taylor has any right to the word "scientific management" as something new. To our own knowledge in this and other countries, the close scrutiny of work with a view to produce greater economy has been the constant study of many. That we, today, even if we adopted in toto with every condition ideal, Mr. Taylor's methods would not produce perfection, as perfection "Dwelleth Not Beneath the Stars." We think that it is rather a slur that is cast on many by Mr. Taylor's appropriating the word "scientific"; certainly, record has been kept and deductions made, and this is scientific, long before Mr. Taylor's exposition came before the public. One thing Mr. Taylor absolutely neglects in furnishing information is the statement of how much of the savings, as laid down by him, costs on his side? How long did it take, and how many dollars were expended in finding out the savings? And this information would certainly be interesting. We admit at once that if a permanent saving of one cent per day can be made, that it has to be multiplied by infinity to get at its final gross footing. But supposing Mr. Taylor took hold of a works for a year, will the saving which he will effect, if the management is already good, offset the cost of the investigation and rearrangement of the business? We feel again like resenting the general expression of Mr. Taylor's book, that the past has been practically all rule-of-thumb.

Scientific Management of Railways. By Louis D. Brandeis. Size, 6½ by 9½ inches. Pages, 92. New York-London: *Engineering Magazine*. Price, $1.00.

Mr. Brandeis is a man who has made the statement that we can save a million dollars a day in railway operation. We are not railroad men and, therefore, on that point we are unable to say nay to Mr. Brandeis, but we have a right to judge this statement by other statements which he makes in this book, or, at least, gives it as coming from him. If the statements about which we know are not correct, we are fair in assuming that the statement of the million dollar saving is a pure guess, excusable perhaps under the excitement of an after-dinner speech, but hardly permissible when written down in cold black and white. On page 15, the following idea is expressed: Thirty-five steel castings are received. The work on them had been set at three hours each.. The machinist took twenty-three hours to machine the first one and then protested loudly. The foreman called the matter to the attention of the superintendent, who said, "Anneal the castings." This was done, but no good resulted. The superintendent went to the general manager, we presume, who tells the "super" to make a special study of the castings. This was done, and a twenty-hour time was set on each. The manager tells the "super" that it was his fault, as he should not have allowed hard castings to come into the shop. The "super" protests and is told that he had better kill the purchasing agent, which he agrees to do. In the meantime, the manager writes to the vice-president, who made a complaint to the steel foundry, telling it not to send any more hard steel castings, and so, according to the book, and we quote from it, "this system resulted in making the vice-president remedy a difficulty that otherwise might have lasted indefinitely." We venture to remark that should the name of this vice-president become known he would have to take to the woods. He would be the most popular human being in the world, he could command any salary, as the users of steel castings will readily admit the supreme ability of a vice-president, or even a president, who can, by writing to steel foundries, obtain always satisfactory castings. There is an old, old saying that a "shoemaker does well to stick to his last." We understand that Mr. Brandeis is a lawyer. Just why the world is suddenly flooded with a mania for using the word "scientific" is hard to understand. Good common-sense in law, in mechanics and elsewhere may not sound quite as well, but, under the guise of science, an immense amount is being perpetrated in the engineering world which is, as one of the New York journals most admirably terms it, "scientific poppycock."

A Valuable Account of Fire Room Methods.

We are constantly invited to consider economy in all our transactions. We must study to turn around once and make it count twice, and, if we work things right, we will "save a million dollars a day" somehow; but every once in a while somebody comes to light who is not saying much, but just doing something. We have an example of this in Mr. F. R. Low's account of his trip to Lawrence, Mass., to meet Mr. George H. Duncan, who is the American Woolen Company's chief engineer, and inspect a battery of boilers planned by him, and stoked by his patent "Hibernian Automatic Stokers," consisting of well-trained Irishmen, who fire at regular intervals and produce most satisfactory economical results, results which save money. It is well worth while to send to the B. F. Sturtevant Company, of Hyde Park, Mass., and get Mr. Low's account of his visit.

Capt. Will J. Ward, editor of the "Maritime Review," Cardiff, has favored us with a copy of his latest novel, "S. S. Cruack, or the Scheme that Failed," which has just been published at 5/-. It is a good yarn, written in Capt. Ward's usual humorous vein.

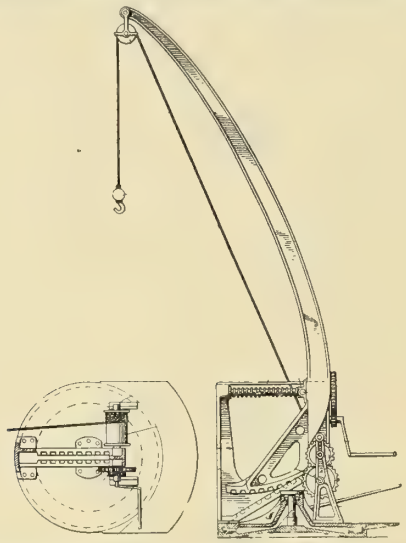
SELECTED MARINE PATENTS.

The publication in this column of a patent specification does not necessarily imply editorial commendation.

American patents compiled by Delbert H. Decker, Esq., registered patent attorney, Loan & Trust Building, Washington, D. C.

986,399. CRANE OR DERRICK. ANDREAS P. LUNDIN, OF NEW YORK, N. Y., ASSIGNOR TO WELIN DAVIT AND LANE & DE GROOT COMPANY, CONSOLIDATED, A CORPORATION OF NEW YORK.

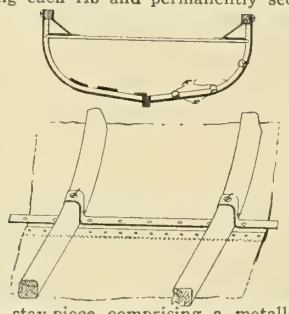
Claim 6.—In a crane or derrick, a frame adapted to rotate about a vertical pivot, a crane arm having a curved surface at its lower end supported to swing vertically in said frame; a base supported by said frame



on which said curved surface rolls, means for preventing said curved surface from slipping on said base, means for swinging the frame horizontally and means for swinging the crane arm vertically.

986,411. BOAT CONSTRUCTION. EINAR L. M. SIVARD, OF BROOKLYN, N. Y., ASSIGNOR TO WELIN DAVIT AND LANE & DE GROOT COMPANY, CONSOLIDATED, A CORPORATION OF NEW YORK.

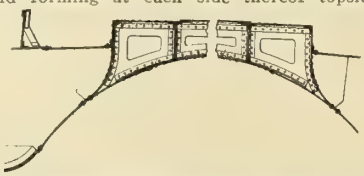
Claim 2.—In boat construction, the combination with an outer metallic plating and transverse wooden ribs, of metallic stay-pieces located at a plurality of places along each rib and permanently securing the rib and



plating together, each stay-piece comprising a metallic strip connected to the metal plating at each side of the rib, spanning the same and also having an independent connection with the rib alone.

986,861. SHIP CONSTRUCTION. JOHN REID, OF NEW YORK, N. Y.

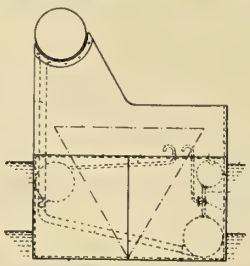
Claim 1.—In ship construction, a hull or outer shell plating, a deck plating, an inner plating extending from said deck plating to said outer shell plating and forming at each side thereof topside ballast tanks



transverse framing terminating immediately below said ballast tanks, longitudinal girders extending along the inside of the walls of said ballast tanks and means for stiffening and supporting said longitudinal girders at intervals throughout the length of said ballast tanks.

986,529. SELF-UNLOADING BARGE. ANDERS FREDRIK WIKING, OF STOCKHOLM, SWEDEN.

Claim 1.—A self-unloading barge, comprising a floating body, a liquid containing receptacle positioned below the deck thereof and at one side



of the floating body, a receptacle located above the deck and at the other side of the floating body, and means for transferring liquid from said first receptacle to said second receptacle.

986,108. SELF-LEVELING COT, BUNK, COUCH. A. L. WERTHEIM, LONDON, ENGLAND.

Claim 1.—A bunk comprising a set of timber frames, a gimbal frame, a cot suspended from said gimbal frame, said cot comprising a body portion, a bracket secured to each corner of said body portion, a plurality of supporting bars, one of said supporting bars passing through each of said brackets, a spring mounted upon said bar, and an adjusting collar mounted upon said bar to adjust said spring.

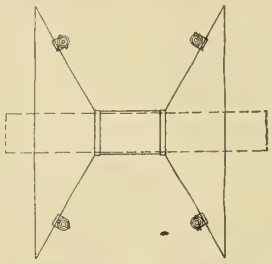
986,373. METHOD OF GENERATING STEAM FOR SUBMARINE BOATS. RAYMOND D'EQUEVILLEY-MONTJUSTIN, OF KIEL, GERMANY.

Claim 1.—In the method herein described for propelling vessels of the submarine type, which consists in using a fired steam boiler to propel the vessel during surface travel, using a hot water boiler to generate steam during submerged travel, and using a soda boiler in connection with the fired steam boiler to supply the necessary steam generating power upon the exhaustion of the hot water boiler, and in conducting the heated water remaining in the hot water boiler to the soda boiler as feed water, whereby to prolong the submerged travel.

British patents compiled by G. E. Redfern & Company, chartered patent agents and engineers, 15 South street, Finsbury, E. C., and 21 Southampton Building, W. C., London.

27,957. RAT GUARDS. B. J. CONOLEY, LONDON.

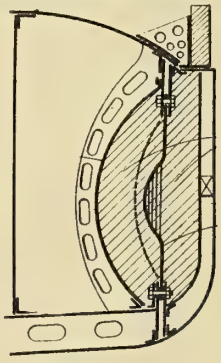
In a prior patent, No. 5,003 (1901), the inventor described a cone to be fitted upon the hawser and form a trumpet-mouth device intended to prevent the passage of rats along the rope beyond the trumpet mouth.



That device is suitable for use in one direction only, but this invention refers to a duplicated device of this type. The trumpet-mouths face in opposite directions and are connected by a central neck portion adapted to be clamped about the hawser.

14,378. SHIPS OR VESSELS. G. E. ELIA, PARIS.

Relates to means for neutralizing the effects of a submarine explosion. The outer plating is backed by a filling of cork or other elastic material of about the density of water, and within which is a framework of steel cables. The packing is backed by heavy plating stayed by framing If an explosion ruptures the plating it compresses the material and deflects the cables, but does no further damage; then the material expands



to its former space. If any is torn away it is of the same density as the water, and the balance of the ship is unaffected. In a modification two containers in an elastic bag are broken by the shock of an explosion so that their contents generate a gas, which expands the bag to press the cables outward to nearly the line of the plating, and thus balance the ship.